PROVINCE OF QUEBEC, CANADA

Department of Colonization, Mines and Fisheries

MINES BRANCH

REPORT ON

MINING OPERATIONS

IN THE

PROVINCE OF QUEBEC

DURING THE YEAR 1917

QUEBEC.
PRINTED BY E. R. CAMPBELL
PRINTER TO THE KING'S MOST EXCELLENT MAJESTY
1918

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Department of Colonization, Mines and Fisheries

MINES BRANCH

Honourable HONORÉ MERCIER, Minister : : S. DUFAULT, Deputy-Minister

THÉO. C. DENIS, Superintendent of Mines

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Province of Quebec.

DEPARTMENT OF COLONIZATION, MINES AND FISHERIES.

To the Honourable Honore Mercier,

Minister of Colonization, Mines and Fisheries,
Quebec.

Sir,—

I have the honour to transmit to you the Annual Report on the "Mining Operations in the Province of Quebec" for the year ending December 31st, 1917.

I remain, Sir,

Your obedient servant,

S. DUFAULT,

Deputy Minister.

Quebec, May 25th, 1918.

Province of Quebec.

DEPARTMENT OF COLONIZATION, MINES AND FISHERIES.

MINES BRANCH

MR. S. DUFAULT,

Deputy-Minister of Colonization,
Mines and Fisheries, Quebec.

DEAR SIR,—

I beg to transmit to you the Annual Report of the Mines Branch for the year 1917.

This report entitled "Mining Operations in the Province of Quebec for 1917" gives the mineral statistics for the year; treats of the mining industry in the Province and its development during 1917; presents the reports of the geological field work done during the calendar year in question.

This report was preceded on February 27th by a preliminary statement of the mineral production, giving provisional figures subject to revision. This revision has been made and the statistical tables given in this volume supersede those of the preliminary statement. It is interesting to note that the difference between the advance figures and the final ones was slightly under one per cent.

Yours very obediently,

THEO. C. DENIS,

Superintendent of Mines.

Quebec, May 25th, 1918.

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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 or shipped," 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 lbs., except when specially mentioned.

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

We endeavour to give values of the mineral products, raw or manufactured, as estimated at the point of shipment or at the pit-mouth; this, however, is sometimes difficult to obtain.

MINING OPERATIONS

IN

THE PROVINCE OF QUEBEC

DURING THE YEAR 1917

STATISTICAL REVIEW

The year 1917 has been a particularly active one for the mining industry of the Province of Quebec, and we record substantial increases in most of the individual items of the "products of the mine" proper. On the other hand, as it might be expected from the economic conditions which have been prevalent for the last three years, the total value of building materials, brick, building stone, cement, clay products, is considerably below that of normal years. But nevertheless the mineral industry has had a very prosperous year, which fact is reflected in the total value of the annual production which has reached the highest figures on record.

The total value of the mineral production of the Province of Quebec for the year 1917 was $16,266,480, a new high level, which is $2,979,436 higher than the previous year's production, which was $13,287,024. The proportional increase is therefore 22%.

The table given further on roughly divides the mineral substances into "Products of the mine" proper and "Building materials." The respective figures of production are $10,819,601 for the first, as compared with $8,088,538 for the previous year 1916, or a proportional increase of 33.8% and $5,447,089 for the structural materials, as compared with $5,278,486, a proportional increase of 3%.

It is interesting to note that for the year before the war the value of the building materials produced in the Province of Quebec constituted 62% of the total mineral production, whereas in 1917 this proportion had fallen to 33%. The production of war material has therefore had a stimulating effect on the mineral industry of the province, but it has adversely affected the operation of stone quarries, clay pits, and sand pits.

TABLE OF THE ANNUAL VALUE OF THE MINERAL PRODUCTION OF THE PROVINCE OF QUEBEC FOR THE LAST 18 YEARS.

YEAR	VALUE	YEAR	VALUE
1900	$ 2,546,076	1909	$ 5,552,062
1901	2,997,731	1910	7,323,281
1902	2,985,463	1911	8,679,786
1903	2,772,762	1912	11,187,110
1904	3,023,568	1913	13,119,811
1905	3,750,300	1914	11,732,783
1906	5,019,932	1915	11,465,873
1907	5,391,368	1916	13,287,024
1908	5,458,998	1917	16,266,480

On reading the remarks given further on, under the headings of the different products of our mines, it will be realized that the increases must be attributed to a more active and almost intensive working of the developed mines, rather than to new fields and new discoveries. In fact, the economic conditions are not favourable to great activities in prospecting, the military requirements having taken many men who in peace time would spend the summer in the bush. The almost prohibitive price of supplies also much militates against it. Moreover funds are not so easily obtainable as a few years ago, for developing and working mineral deposits once found.

The following table gives the details of the mineral production of the province in 1917, and in the last column we have added the values of the same items for 1916 for the purpose of comparison.

TABLE OF THE MINERAL PRODUCTION OF THE PROVINCE OF QUEBEC DURING 1917

SUBSTANCES	No. of workmen	Salaries	Quantities	Value	Value in 1916
		$		$	$
Asbestos, tons	3,154	2,035,272	137,242	7,198,558	5,182,905
Asbestic, tons	.....	.....	17,210	42,139	28,252
Chromite, tons	268	215,443	36,186	498,031	312,901
Copper and Sulphur ore, tons	311	305,210	122,822	1,205,242	1,259,064
Feldspar, tons	.....	.....	1,195	8,225	20,760
Gold, oz	21	5,996	1,116	22,570	13,041
Graphite, lb	90	74,853	1,078,000	99,024	75,776
Iron ores and titaniferous iron, tons	21	9,680	16,028	54,135	8,281
Kaolin, tons	27	22,000	833	11,744	17,500
Magnesite, tons	294	196,064	58,340	729,025	525,966
Mica, lb	220	77,481	1,531,629	281,234	177,814
Mineral waters	11	1,227	.....	6,553	18,574
Mineral paints, (Iron oxide ochre)	69	34,167	9,252	69,536	62,875
Molybdenite, lb	289	144,637	226,739	238,096	129,267
Phosphate, tons	.....	.....	110	1,320	2,291
Quartz and Silica, tons	41	15,706	10,876	32,511	27,810
Silver, oz	.....	.....	96,620	78,880	38,113
Zinc and lead ores, tons	190	158,635	4,618	242,778	107,348
BUILDING MATERIALS					
Brick, M	553	334,360	67,745	530,594	762,689
Cement, bbls	530	536,348	2,079,404	3,264,664	2,525,841
Granite	184	92,452	.....	167,659	292,270
Lime, bush	188	101,776	1,500,728	343,588	276,245
Limestone and marble	963	391,980	.....	749,592	978,945
Sand, building	111	51,644	.....	161,840	168,891
Slate, sq	19	10,933	1,422	7,789	6,223
Sandstone	12	6,398	.....	7,475	8,190
Tile, drain and sewer pipe, pottery, etc	146	75,486	.....	213,678	259,192
	7,712	4,868,748	.....	16,266,480	13,287,024

CHEMICAL LABORATORY

The Quebec Mines Branch maintains at the Polytechnic School of Laval University, 228 St. Denis Street, Montreal, an up-to-date, well equipped laboratory, for the convenience of the interested public. Analyses and assays, determinations of minerals, and tests of various ores, samples and materials found within the boundaries of the province of Quebec, are made in this laboratory at prices which are extremely low for the high-grade work done. The laboratory has been established for the sole purpose of aiding the development of the mineral resources of the province of Quebec. Prospectors and all persons interested in the Quebec mineral resources are cordially invited to avail themselves of the facilities offered. The tariff in force for the analysis and assay of various substances is given further on, and it will be realized that the fees are very low, as the high competence of the chemists ensures results of undoubted reliability.

During the year ending December 31st, 1917, the Provincial Laboratory effected 601 analyses and assays as follows:

Gold 110; silver 70; aluminium 1; arsenic 2; barium 1; carbon 6; lime 35; chrome 13; copper 18; water 2; tin 1; iron 47; magnesia 37; manganese 2; nickel 3; phosphorus 14; lead 16; platinum 2; potassium 5; silica 30; sulphur 32; titanium 13; tungsten 1; zinc 8; combustions 9; radioactivity 3; qualitative tests and identifications of minerals and rocks 120.

Province of Quebec.

GOVERNMENT ASSAY LABORATORY

(Under the direction of the Department of Mines of the Province of Quebec as an aid to the development of the mineral resources.)

TARIFF OF FEES FOR ASSAYS AND ANALYSES

DETERMINATIONS	Less than 5 samples Each:	For5 samples or more Each:
	$ Cts.	$ Cts.
Moisture	0.25	0.25
Combined Water	0.50	0.50
Gold and Silver	1.00	0.90
Silica, Copper, Iron — 1 constituent	1.00	0.90
Silica, Copper, Iron — 2 constituents in same sample	1.75	1.50
Iron, in titaniferous ore	2.00	1.80
Alumina, Cobalt, Graphite, Lead, Lime, Magnesia, Nickel, Sulphur — 1 constituent	1.50	1.35
Alumina, Cobalt, Graphite, Lead, Lime, Magnesia, Nickel, Sulphur — 2 constituents in same sample	2.50	2.25
Antimony, Arsenic, Bismuth, Chromium, Manganese, Molybdenum, Phosphorus, Platinum, Titanium, Zinc — 1 constituent	2.00	1.80
Antimony, Arsenic, Bismuth, Chromium, Manganese, Molybdenum, Phosphorus, Platinum, Titanium, Zinc — 2 constituents in same sample	3.50	3.15
Commercial analysis of an iron ore, comprising determination of silica, iron, phosphorus, titanium and sulphur	6.50	5.85
Commercial analysis of a limestone or cement, comprising silica, lime, iron, alumina, magnesia, and sulphuric acid	6.00	5.40
Commercial analysis (proximate analysis) of a fuel, comprising: ash, volatile combustible, fixed carbon, moisture	3.00	2.70
Calorific power of a fuel	1.50	1.35
Radioactivity of a mineral	1.00	0.90
Radioactivity of a mineral water	2.00	1.80

Determinations of Minerals.—For a nominal fee of 25c. for each sample, the laboratory will make determinations of ores and minerals, provided rapid tests will allow it, and issue a report on probable contents and commercial value of specimens and samples.

Terms.—Money in payment of fees, by registered letter, postal notes or orders, must invariably accompany the samples, in order to insure prompt return of certificate.

Professor E. DULIEUX.
In charge of Laboratory
No. 228 St. Denis St., Montreal.

MINING OPERATIONS

ASBESTOS

The keen demand for asbestos has resulted in sharp increases in prices during 1917, more especially for the higher grades. As in the two previous years the shortage of labour has been felt. The production of asbestos reached 137,242 tons, valued at $7,198,558, ascompared with 133,339 tons valued at $5,182,905. The tonnage increased 3%, whereas the value shows an advance of 38.9%.

The average price per ton rose to $52.45. In 1916 this was 38.87; for the previous years the figures were $31.33 in 1915; $26.96 in 1914 and $28.04 in 1913.

The total quantity of asbestos-bearing rock mined and hoisted during the year was 2,634,410 tons. The value of the asbestos extracted from it, counting stocks on hand at the end of the year, was $8,120,409. This represents a value of $3.08 of asbestos extracted from each ton of rock. In 1916, 1915 and 1914 these values were $2.13, $1.46 and $1.44 respectively.

On March 7th, 1917, an order-in-council was passed, decreeing, in conformity with article 2105 of the Mining Law of the Province of Quebec, that a royalty of 5% after deducting working costs, be collected on all asbestos produced from the mines in the Province after April 1st, 1917.

Later, on April 27th, the producers of asbestos unanimously proposed to the Government of the province, that the above royalty be changed into a royalty of 2% on the gross value of the asbestos extracted, sold or shipped in the province or out of it.

An agreement was therefore entered into between the producers of asbestos and the Government, and on May 15th a new order-in-council was passed decreeing:—

1o. That from the 1st of May, 1917, the only royalty on asbestos shall be 2% of the gross value of this mineral extracted from the mines of this province;

2o. That this royalty shall be payable semi-annually on the 30th of June and the 31st of December respectively, to the Department of Colonization, Mines and Fisheries.

Returns of shipments of asbestos were received from fourteen operators as follows:—Anglo-Canadian Export Company, Asbestos Corporation of Canada, Bell Asbestos Company, Bennett-Martin

Asbestos and Chrome Mines, Black Lake Asbestos and Chrome Co., Federal Asbestos Company, Frontenac Asbestos Mining Co., Imperial Chrome Company, Jacobs Asbestos Mining Co., Johnson's Company, J. M. Johnston, Manville Asbestos Co., Martin-Bennett Asbestos Co., Quebec Asbestos Corporation. Seventeen mines were worked.

PRODUCTION OF ASBESTOS IN THE PROVINCE OF QUEBEC FOR 1917

Designation of Grade	Shipments and Sales		Average Value per ton	Stock on hand Dec. 31st 1917	
	Tons	Value		Tons	Value
Crude No. 1	1,761	$1,370,740	$778.38	580	$ 470,923
Crude No. 2	3,603	1,374,387	381.46	746	269,766
Mill Stock No. 1	13,197	1,318,387	99.90	1,089	206,124
Mill Stock No. 2	54,072	1,988,197	36.77	3,346	141,344
Mill Stock No. 3	64,609	1,146,847	17,75	7,447	124,735
Total	137,242	7,198,558	52.45	13,208	1,212,892
Asbestic	17,210	42,139	2.45	263	805
Total	154,452	7,240,697		13,471	1,213,697

Quantity of rock mined during the year 1917, 2,634,410 tons.

PRODUCTION OF ASBESTOS IN THE PROVINCE OF QUEBEC IN 1916

Designation of Grade	Shipments and Sales			Stock on hand Dec. 31st 1916	
	Tons	Value	Average Value per ton	Tons	Value
Long Fibre, Crude No. 1	3,073	$1,299,138	$422.76	255	$100,931
Long Fibre, Crude No. 2	2,885	634,041	219.77	201	28,596
Mill Stock No. 1	11,768	936,373	77.57	847	86,728
Mill Stock No. 2	43,870	1,248,740	28.46	1,500	55,971
Mill Stock No. 3	71,743	1,064,613	14.84	3,473	61,425
	133,339	5,182,905	38.87	6,276	333,651
Asbestic	20,710	28,252	1.36	228	334
Totals	154,049	5,211,157		6,504	333,985

Quantity of rock mined during the year 1916, 2,291,087 tons.

The Asbestos Corporation of Canada, formerly the Amalgamated Asbestos Corporation, operated three of its five mines. The King mine and the Beaver mine at Thetford, and the British-Canadian mine at Black Lake. The other two properties, the Standard and the Dominion were not reopened during 1917.

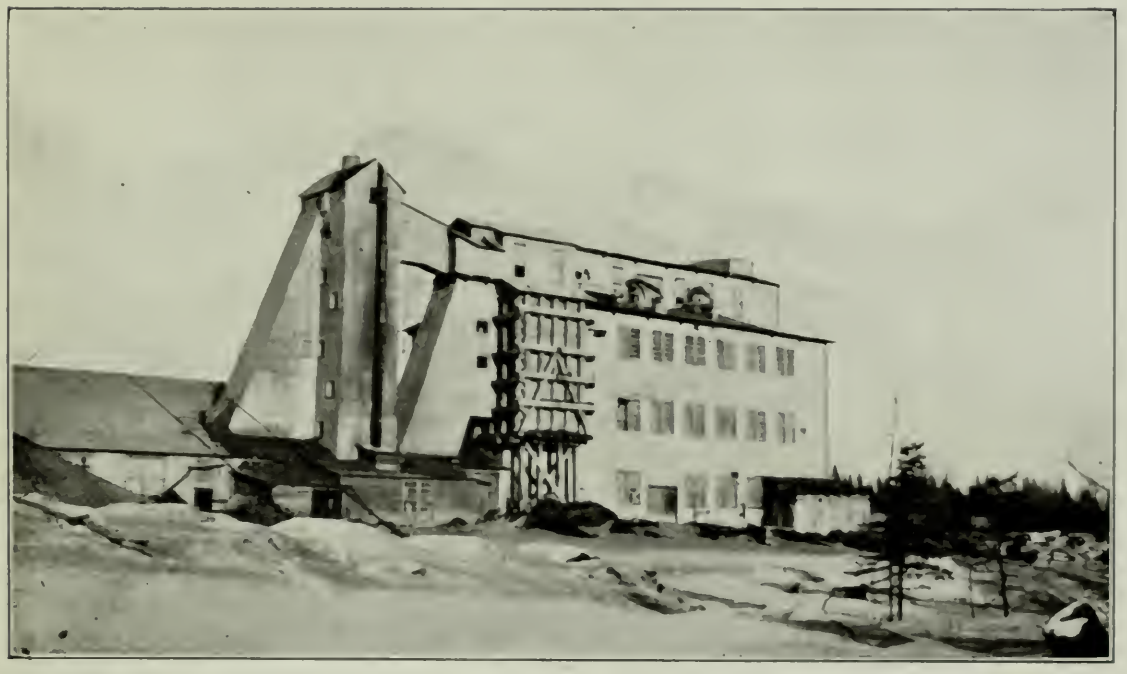
At the King mine the extensive alterations, both in the mine and in the milling practice, begun three years ago, have been practically completed. The large covered storage bin for the dried rock, of a capacity of 25,000 tons, is now being used and it feeds the mill by means of conveyor belts. The new crushing and drying plant is also in operation, and consists in the main, of two jaw-crushers, opening of jaws 72 by 32 inches, of a capacity of 100 tons an hour, and vertical dryers. The rock hoisted from the pit passes through the crushers, then through the dryers. It falls in the boots of bucket elevators and is raised to the upper part of the bin, in which a conveyor belt distributes it evenly. The contents of the storage bin are discharged at the bottom, by a series of openings, on to a conveyor belt which feeds the mill.

A tunnel for the ingress of the workmen to the pit and their egress is about completed. This passage is over 900 feet long and access to it is by means of a circular shaft, 75 feet deep, with a spiral staircase. The shaft is located near the mill, to the south of the railway. The pit is now lighted during the night by eight nitrogen lamps of 1000 watts each. The great advantage of these over the arc-lights is that the light is quite steady. Moreover, they use much less current for the same amount of light.

At the Jacobs mine preparations are actively pushed to commence a system of underground workings, on the principle of the "Glory hole" method, and hoisting by shaft. The shaft at the end of the year was down 515 feet, and a main level of 1400 feet had been driven on the south west part of the pit. From this level a series of crosscuts branch out, and from these cross-cuts inclined raises were being driven to the surface.

A large crushing and drying plant is being erected. Pending the completion of these alterations, work is carried on by the old methods of open pit and cable-derricks. It is expected that the new method will be put in operation in the spring of 1918.

The Bennett-Martin Asbestos and Chrome Mines, Limited, have proceeded with the development of their property, lots 24 and



Asbestos Corporation of Canada.—Asbestos Mill at the Fraser Mine, lot 14, range VII, Township of Broughton, Que.

Quebec Asbestos and Chrome Co.—General view of the Sterrett Mine, lots 7 and 8, range X, Cleveland township.

25, range III of Ireland. The results have been very satisfactory and they have shipped an appreciable quantity of crude. All the rock has been set aside awaiting the completion of the mill which is being built.

In the East Broughton field, the Quebec Asbestos Corporation, a company which took over the property of the Ling Asbestos Company, after extensive alterations in the mill and in the mine, began producing in May, 1917. The cable derricks have been discarded and the rock is handled in the pit by steam-shovels and cars which convey it to crushers put up in the pit bottom. The crushed rock is then brought to the surface by elevators and dropped on a conveyor belt which discharges into the dryer-bins.

The Asbestos Corporation has acquired and reopened the old Fraser mine at East Broughton, lot 14 range VII, Broughton township. The buildings of the mill which had been constructed at the Standard mine at Black Lake, several years ago, were transported to the Fraser mine and re-erected there. But none of the old machinery was used. This old machinery had been designed for crushing by rolls, a principle which did not prove satisfactory. Therefore, of the old mill only the building was used. The Fraser mill began to produce in December, 1917, and treats 500 tons of rock per day.

An attempt was made, by the Anglo-Canadian Export Co., to reopen the old Normandin mine on lot 13, range V of Broughton and to use the mill of the Boston Asbestos Company to treat the rock. A few tons of fibre were produced but the undertaking was abandoned as being unremunerative.

There was a resumption of work at the Belmina Mine, lot 24, range II of Wolfestown township, but the production was limited to a small quantity of crude asbestos. The work which was done by Mr. Jos. M. Johnston, of Black Lake, mainly consisted in cleaning the pits, and doing some development, in the expectancy of interesting capital in a reopening of the mine.

Work was also carried on on lot 29, range A, Coleraine, an old property of the Reed Estate, by Messrs. Lambly and Frechette, under the name of Imperial Chrome Company. Only crude asbestos was produced.

At the Jeffrey mine, in the Danville field, of the Manville Asbestos Company, which is the reorganized Asbestos and Asbestic Company, development and improvements in the mining methods have

been carried on, the ultimate aim of which is the adoption of steam shovels to load the cars at the bottom of the pit and the direct hauling of these to the mill, eventually eliminating entirely the cable-derrick system of hoisting. Some of these derricks have already been discarded and their number has been reduced from twenty to twelve. It is claimed that the new method will effect a very substantial economy in the handling of the rock.

ASBESTOS IN OTHER COUNTRIES

Southern Rhodesia.—The asbestos production of Southern Rhodesia is yearly growing in importance and bids fair to give rise to a large industry.

The following table shows the development of asbestos mining in Southern Rhodesia since its beginning in 1908.[1]

Year	Long Tons	Value.
1908	55	$ 2,678
1910	332	16,168
1914	481	41,940
1915	2,010	156,765
1916	6,157	482,217
1917	9,563	925,714

The South Rhodesia asbestos is chrysotile and it must not be confounded with the blue asbestos or crocidolite of the Cape provinces. Its quality is good, although it is rather brittle and does not possess the silkiness of Quebec asbestos.

Some interesting notes on the asbestos occurrences were given in the report of the Director of the Geological Survey of Southern Rhodesia for the year 1911, and extracts are here reproduced.

"The Asbestos quarries belonging to the Rhodesia Asbestos Company, Limited, are situated in the north western corner of the Mashaba Mountains about 26 miles west of Victoria and three to four miles south of the Selukwe-Victoria road. From the latter a branch road leads to the quarries from the east side of the Shashi river, and another leaves it about two miles west of the Umsungwe river ("20-mile spruit") on the route from Victoria.

[1]See Reports Rhodesia Chamber of Mines, Bulawayo.

"After leaving Victoria Townlands the road to Selukwe traverses a granite country. Much of the granite is of the massive variety which builds the characteristic castles kopjes, but the banded gneissic forms are also met with. Here, as around Selukwe, the banded varieties crop out in bare flat surfaces or low swelling ridges, the scenery being tamer than in the country of massive granite. A few dykes of basic igneous rock traverse the granite, in addition to the pegmatite, aplite, and quartz veins.

"Between "15-mile spruit" and the Umsungwe river ("20-mile spruit") the road crosses, by a col, a bold range of hills, trending north and south and formed of serpentine, which weathers a rusty brown colour and is frequently silicified near the surface.

"Beyond this range the road again traverses low lying country underlain by gneissic granite. Shortly after leaving the main road the granite is left behind, and the track runs on serpentine to the foot of the Mashaba Mountains. These hills rise up with precipitous slopes to a great height and are visible for many miles around. They are typical serpentine hills, clothed with vegetation to their tops, except for the occasional dark-coloured crags.

"The serpentine alters at the surface to a rusty red colour, from which the mountains get their name of Mashaba, meaning red. Below the weathered zone the rock is dark grey or nearly black, and whilst some of the serpentine was doubtless derived from olivine rocks, other portions appear to be the result of the alteration of pyroxenites.

"The asbestos quarries are situated on a belt of serpentine trending east and west, and lying in a hollow in the north-western corner of the hills. South of the quarries is a band of serpentine not carrying asbestos, and then follows an area of metamorphic rocks which includes banded ironstones, phyllites, quartzites, etc. They are traversed by pegmatite veins and massive dykes of dolerite.

"No sections showing the relation between the serpentine and surrounding rocks were seen. By analogy with other districts, it is probable that the rocks from which the serpentine is derived were intruded into the metamorphic schists (Banded Ironstone Group, etc.), and that the granite is later than the serpentine, but this relation has not been actually proved here.

"Two quarries have been opened in the asbestos belt and clearly expose the mode of occurrence of the fibre. As already remarked the belt has an east and west strike, and is some 200 yards broad. It is divided into zones of pale green and greyish brown serpentine, which run parallel with the belt and dip due N. at 30°. The brown zones being 3 feet to 6 feet wide are generally thicker than the green zones, which measure 1 foot to 4 feet in breadth. All the asbestos is contained in the green zones, the brown ones being barren. Further the best fibre occurs in the middle of the green zones; that lying near the junction with the brown zones on either side is generally hard and brittle. The bands vary from a small fraction of an inch up to 1¼ inches in width. Bands two or three inches broad are occasionally seen. They consist of a number of the ordinary bands lying side by side, for the fibre does not run across the whole or three inches, but is separated by thin partings of gangue. The deposit is thus not rich in the longest chrysotile fibre, known in commerce as "Crude No. 1" and composed of fibre over ¾ inch in length, but it does contain a large supply of good marketable fibre. Mr. E. Dickson, the manager, estimates that with an output of 200 tons a month he has several years' supply in sight, and that without going below 60 feet from the surface. What might be called "probable ore," known only through surface prospecting and a few shafts and trenches, is a vastly greater body.

"Much of the fibre is separated from the country rock by hand 'cobbing,' the good material being separated more easily than poor stuff. Fibre which becomes mixed with small broken rock in quarrying and in cobbing, is separated on riddles, which are held in an inclined position and given a jigging motion, by which the fibre collects at the top of the riddles and the stones at the bottom, sand, of course, passing through. There is no difficulty in getting natives for this work.

"The mill, started in 1910, is designed to carry out the operations of cobbing and sorting continuously. It consists of a heavy rock-crusher delivering over a screen to rolls, from which the material is elevated and sorted on shaking screens of three sizes. The product is thus graded into four sizes, and exported in sacks of a hundredweight each."

It may be noted that in 1917 the Rhodesia and General Asbestos Corporation, with a capital of £400,000 was organized to acquire asbestos mines and properties of the Charterland and General Ex-

ploration Company and of the Victoria (Rhodesia) Asbestos Company. The Company belongs to the same group as the Rhodesian Chrome Mines.[1].

The following remarks are extracted from an article by Dr. Percy A. Wagner, published in the November issue of the *South African Journal of Industries*, and reproduced in the *Mining Magazine* of March 1918:

"The most important South African deposits of chrysotile asbestos are those of Southern Rhodesia, which at the present time are producing over 900 tons per month of excellent quality. The Rhodesian fibre is the only class of chrysotile asbestos that has been able to compete successfully with the best grades of Canadian crude. The mineral was first discovered in the Mashaba mountains, about 26 miles west of Victoria, and the Victoria district until quite recently ranked as the premier producer. Within the last two years, however, extensive and rich deposits have been opened up in the Belingwe district, and the output of these is at the present time slightly in excess of that of the Victoria district mines. Asbestos is also being worked in the Gwelo district, and finds have recently been reported from the Lomagundi district. The deposits are all in belts of ancient serpentine, and as these are extensive and as yet but little known many important occurrences no doubt still await discovery. The asbestos is of the cross fibre variety, and occurs under the same conditions as the Canadian, in irregular narrow veins ramifying in every direction through the enclosing serpentine. The fibre ranges in colour from pale green to pale greenish-white, that of Belingwe district being somewhat longer and also more silky than that of the Victoria district. The fibre is readily separated from the matrix by cobbing, crushing, and screening. No attempt is made to save the shorter grades of fibre."

Tasmania.[2]—Occurrences of asbestos have been known for a long time in Tasmania, and in 1889 several leases were taken up by the Australasian Asbestos Company, who worked them for two years, and shipped 373 tons of stone to the mainland for the manufacture of asbestos plaster, in which the fibre took the place of hair. The undertaking was abandoned, but of late, attracted by the high prices ruling, the Durasbestos Company of Sydney has taken up the leases and active prospecting is now going on.

---

[1]From *Mining Magazine*, London, Aug. 1917.

[2]See Mineral Resources, Bulletin No. 4, Geological Survey, Tasmania, Hobart.

"The belt of serpentine rock in which asbestos occurs on each side of Anderson Creek, is about a couple of miles in length from north to south, and 1½ miles in width. Anderson's Creek, a perennial stream, flows through the belt, and empties into the West Arm at about 1½ miles north of the northern boundary of the fibre area. The township of Beaconsfield is situate 2½ miles east of it and is connected with the field by means of a somewhat rough cart road."....."The serpentine rock of Anderson's Creek is confined to an area which was previously occupied by peridotites and pyroxenites."[1]

UNITED STATES.—In the United States asbestos was produced in 1917 in Arizona, California, Idaho, Georgia, Vermont and Virginia. At Washington, California, the Washington Asbestos Mines Company secured a large deposit of chrysotile asbestos and is mining and milling an average of 15 tons a day.[2]

In 1916 the marketed production of asbestos was 1479 short tons, valued at $448,214. This was a decrease of 15% in quantity, but a gain of 482 per cent. in value.[3]

COPPER AND SULPHUR ORE.

Judging from the activity at the beginning of 1917, a much larger production of copper bearing pyrite was anticipated for that year as compared with 1916. But during the second half of 1917, great difficulty was encountered in getting the freight cars necessary for shipping, and the supply of labour was very inadequate. As a result, the total quantity shipped was 122,822 tons valued at $1,205,242. In 1916, these figures were 131,017 tons valued at $1,259,064. This is a decrease of 6.3% in tonnage and of 4.3% in value.

The market for pyrite, for the manufacture of sulphuric acid, has been very uneven. The demand has been active owing to war ends, but the supply has been uncertain. The basis of price in the United States has always been the Spanish pyrite. Nominal quotations for this pyrite throughout the year have been 15 cents per unit, on a basis of 10 shillings freight per ton, extra freight and war risks

[1]Asbestos at Anderson's Creek, by W. H. Twelvetrees, Geological Survey of Tasmania, Hobart.
[2]Engineering and Mining Journal, Jan. 12th, 1918
[3]Mineral Resources of United States, 1916.

at the charge of the buyers. Ocean freights, when available, varied between 32 and 42 shillings; in July they were 42s 6d for southern ports, which brought the Spanish pyrite to 32 cents per unit ex-ship. In August the freight rates eased off to 40 shillings for southern ports and 32s 6d for northern ports.

Very little domestic pyrite was available in the market, as most was produced under unexpired contracts.

In May, quotations were given of 10 to 16c a unit, per long ton, rising later to 20c. In October there were records of sales at 25c a unit for lump and 23c for fines. In December prices reached 30c. and Georgia lump sold at 35c a unit, all taken at shipping points.

In the province of Quebec only two operators reported production, and although a considerable amount of prospecting was done on various deposits in the Eastern Townships no actual mining resulted.

The Weedon Mining Company operating the Weedon or McDonald mine, on lot 22, range II of the township of Weedon, developed their workings by sinking operations in their two inclined shafts to a depth of 950 feet. In depth the vein, or lens narrows, but this is compensated by higher contents in copper.

The Eustis mine and the mill were worked continuously, but all operators complain of the lack of adequate labour. The Eustis mill replacing the one which was destroyed by fire in 1915, for the concentration of fines, is giving very satisfactory results. The ore from the mine is separated into rich ore and lean ore, the former being crushed and shipped in lumps, the latter being sent to a Jenckes gyratory crusher and treated by a Richards classifier, followed by eight Wilfley tables, Dorr thickener, and Callow cells.

The Eustis Mining Company did some work on the old Hepburn mine, with the intention of reopening it. Moreover steps were taken to work over the dumps of the Moulton Hill and Howard mines, but these operations were hampered by the lack of labour. The wages for common labour of very inferior quality are now $3.25 a day.

The Canadian Copper Company, of Copper Cliff, Ont., undertook to test the old Victoria mine, on lot 4, range VIII, Ascot township, but, after some diamond drilling, operations were abandoned, the results having, apparently, been unsatisfactory.

No work has been done since 1914 on the group of mines controlled by Mr. A.O. Norton, comprising the Suffield mine, the Ascot mine, King mine, Silver Star mine, on lots 2, 3 and 4, range XI, and the Marrington mine lot 6, range IX of Ascot, but it is possible that work may be resumed in 1918.

In December 1917 steps were being taken by Mr. S. E. Melkman to do some diamond drilling on the Stratford prospect, lot 8, range VI S.W. of Stratford township.

NOTES ON COPPER OCCURRENCE AT NEWPORT, GASPE COUNTY, P.Q.[1]

This deposit is located on lot 5 range I, Newport township, County of Gaspé. It was discovered and staked by Mr. W. E. Lenthall, who subsequently transferred his mining license to the Gaspé Syndicate, with head office at 511 Shawmutt Building, Boston, Mass. The mining claim comprises a rectangle 25 chains long and 18 chains wide, along the west side of the railroad.

The work done here comprises a prospecting shaft, or pit, 10 feet by 10 feet, some 15 feet in depth, and a certain number of trenches scattered in various points of the property. The shaft is a quarter of a mile distant from the railway, whereas the main stripping and trenching was done on rock outcrop, 200 feet from the track.

The equipment at the shaft comprises a steam boiler, 14 H.P. to run a hoist and steam drills. On the other points of the claim all work is done by hand.

On the surface the ore consists of carbonate of copper and chalcopyrite, in small veinlets, cutting a volcanic tuff of a dark grey colour. The tuff is also cut by veins of pinkish quartz and red porphyritic quartz in which are present chalcosite and cuprite. Some of the rock, veined with quartz, contains epidote and chalcopyrite.

Traces of the presence of copper ore on this property are numerous, but always in very small quantities. Further prospection would be necessary to enable to arrive at a conclusion regarding the economic value of the occurrence.

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[1]Notes by Mr. A. Mailhiot (Translated from the French).

IRON ORES.

The shipments of iron ores, comprising both iron ores proper and titaniferous iron ores used as ores of titanium, amounted to 16,028 tons, valued at $54,135, according to the returns received at the office of the Quebec Mines Branch.

The larger part of the tonnage was made up of shipments of ores from the Bristol mine, which had been lying on the dump since 1893, year in which mining operations at this mine were discontinued.

A small quantity of magnetite which had been lying on the dump of the Forsyth mine, near Hull, was shipped and utilized in the burning of magnesite. This has been referred to under "Magnesite."

The balance was titaniferous iron ore shipped to Niagara Falls for the manufacture of Ferro-titanium. Part of this ore was mined at the Saint-Urbain mine in Charlevoix county and part was mined from the property of the Manitou Iron Mining Company, at Ivry, near St. Jérome.

A chapter in the history of the iron industry of the Province was closed during the year 1917, by the dismantling of the charcoal blast-furnaces of Drummondville and Radnor Forges.

The district of Trois-Rivières, in the region of the lower St. Maurice river, had been the scene of an iron smelting industry since 1733, using the bog iron ores of the vicinity. The first plant was erected in that year some eight miles above Trois-Rivières, on the west side of the St. Maurice, and this was worked, more or less continuously until 1883.

In 1860 a blast-furnace was erected at what was later known as Radnor Forges, and in 1889, the Canada Iron Furnace Company was formed for the purpose of acquiring the iron interests of Radnor Forges, as well as foundries and shipping docks at Trois-Rivières.

In 1908 the Canada Iron Corporation was formed, to take over the plants of both the Canada Iron Furnace Company, at Radnor, and the furnace plant of the John McDougall Company, at Drummondville, on the South shore of the St. Lawrence. The Canada Iron Corporation also acquired important blast furnace plants and iron ore mines in Ontario, in Nova Scotia and in New Brunswick.

At that time the Radnor furnace was being charged with bog iron ore of the St. Maurice district, magnetite from Ontario and about equal proportions of wood charcoal and coke. The two furnaces at Drummondville consumed local bog ores and wood charcoal exclusively.

In 1910, the Radnor furnace stopped operating, and in 1911, the Drummondville furnaces were also put out and none were subsequently relighted. In 1912, the Canada Iron Corporation went into the hands of a receiver and on reorganization under the name of Canada Iron Foundries, Limited, all operations at Radnor and Drummondville were abandoned and the furnaces and plants were finally dismantled in 1917.

CHROMITE

The figures of production of chromite received show that a quantity of 36,186 short tons, valued at $498,031 was produced during the year. The tonnage, however, is greater than the quantity actually shipped to the consumer, for a certain proportion represents low grade ore of 12 to 25 or 30% of sesquioxide, sold by miners to concentrators where it was enriched to 45 or 50 per cent. About 23,000 tons represents the quantity which reached the consumer.

The figures constitute a new high record. As the demand for chromite is extremely active owing to the war needs, and ocean freight from New Caledonia and Rhodesia being very difficult to obtain, it may be expected that the market for Canadian chromite will keep up while the present abnormal economic conditions prevail.

A preliminary estimate of the needs of chromite of the United States for 1918 puts these requirements at 120,000 long tons of high grade ores, and 40,000 long tons of low grade ore for refractory purposes.

It is in the interest of the chromite mine operators and owners of chromite properties, as well as a patriotic duty on their part, to do all in their power to increase the production of chromite during the year 1918. Never were the conditions more favourable for an active development of all possible deposits of chromite, and it would well pay to closely examine and prospect all known occurrences in the serpentine belt from Thetford Mines to the Vermont boundary.

The standard of marketable ore has been considerably lowered with the increased needs, and a large proportion of the ore sent to the concentrating mill of the Mutual Chemical Company at Black Lake did not go over 12%. Therefore numerous deposits, which under the conditions prevailing a year ago, would not have been workable, might at the present time yield some profits. As an instance of the demand for chrome ore the following note is taken from "The Market Report" of the *Engineering and Mining Journal* of March 30th, 1918: "Chrome ore.—Reports of business in 40 to 43% done at $1.50 a unit, delivered at New York, and of high grade ore offered at $1.50 to $2.00 at shipping points, but that very little 50% is available."

In January, 1918, chrome ore of 50% was quoted $1.25 a unit. It may be pointed out that past experience has proved that workable chromite deposits are not confined to the immediate Coleraine district. The success which has attended the development of the deposit on lots 7 and 8, range X, of Cleveland township from an insignificant occurrence in a new area, to one of the most important producers in a few months should be an incentive to leave no stone unturned, and it shows that new producing areas may reasonably be expected.

The following is a list of localities from which the presence of chromite in place has been reported. This list is compiled from various reports and comprises all the present producing mines, as well as other occurrences, many of which may well be worth investigating.

Coleraine Township.—Blocks A and B; range A, lots 15, 16, 17; Range B, lots 5, 6, 7, 8, 12, 13, 23, 26, 28; Range C, lot 32; Range I, lot 22; Range II, lots 22, 25, 26, 27; Range III, lots 25, 26; Range IV, lots 4, 5, 7, 8, 9, 10, 25; Range X, lots 1, 2, 3, 4, 5, 6, 19 N.W.; Range XIII, lots 2, 4, 5, 6, 7, 8, 9.

Wolfestown Township.—Range II, lots 24, 28; Range III, lots 23, 24, 25, 34; Range IV, lot 26.

Garthby Township.—Range I, lots a, b, c, i; Range II, lots 4, 5, 6, 7, 8; Range V, lots 36, 37.

South Ham.—Range I, lots 21W, 24, 27; Range II, lots 4, 20, 21, 40; Gosford Road range, lot 27.

Thetford.—Range III, lot 8; Range IV, lots 16, 17, 18; Range V, lot 17.

Leeds.—Range X, lots 1, 10.

Ireland.—Range I, lot 28; Range II, lots 24, 25, 26, 27, 28; range III, lot 26.

Cleveland.—Range X, lots 7, 8, 9.

Melbourne.—Range VI, lot 22.

Bolton.—Range IV, lot 13; Range VI, lots 26, 27; Range VII, lots 9, 13, 23, 26.

Brompton.—Range IX, lots 25 and 26.

Orford.—Range XII, lot 4.

The *Mining Journal*, of London, has given a list of the requirements of the various users and buyers of chrome ores of the United States.

The American Refractories Company, La Salle St., Chicago, specify 40 to 50% Cr_2O_3, maximum of 15 per cent iron oxide and 8% silica.

Binney & Smith, New York, 50% chromic oxide, maximum of 3% silica. Also purchase ore of 38 to 40%.

Electro-Metallurgical Company, New York, buy high grade ore for manufacture of ferros.

Foote Mineral Company, Philadelphia, manufacture ferro-chrome and bichromate; minimum 50% chromic oxide and maximum silica 6% for chemical ore and 40% chromic oxide and maximum 5% silica for metallurgical ore.

Goldschmidt Thermit Company, New York. Manufacture 60% carbon free chromium. Require 50% ore, maximum silica 1.5% and no sulphur or phosphorus.

Harbison-Walker Refractories Company, Pittsburg. Maxima, 6% silica and 15% ferric oxide.

Mutual Chemical Company, New York. Manufacture bichromates. Minimum 48% chromic oxide, maximum 6% silica.

National Electrolytic Company, Niagara. Manufacture of bichromate, 50% chromic oxide.

Noble Electric Steel Company, San Francisco, minimum 30% metallic chromium, maximum 10% silica.

Pacific Electro Metals Company, San Francisco. High in chromium and low in silica, for ferro-chrome.

St. Louis Refractories Company, St. Louis. Chrome ore between 34 and 40%.

The Sawyer Tanning Company, Napa, California. Chromite 47% chromic oxide and maximum of 8% silica.

According to the same authority, the production of chromite in Rhodesia in 1916, was 88,871 long tons and in 1917, 72,962 tons.

Operators in 1917.

Very successful mining operations were carried on during 1917 on lots 7 and 8, range X, of Cleveland township, by Mr. Douglas B. Sterret at first, and subsequently by the Quebec Asbestos & Chrome Company, with head office at St. Cyr, near Danville, which was organized to work this mine, one of the largest producers.

The deposit, on which the first work was begun in November 1916, is a series of elongated lenses in échelon, the width of which varies from a few inches to a maximum of 18 feet. The general direction of the lenses is N. 25° E. This series has been opened over a length of 1400 feet and the work so far has been by open cuts and open stopes. The intention is to commence a method of underground mining at an early date and shaft sinking has begun. This is a new deposit in a new chromite area and such results should encourage prospecting wherever serpentines are known to occur.

The Black Lake Asbestos & Chrome Company carried on some mining work for chromite on Blocks A and B of Coleraine township. This work was carried on by contractors and tributors, and part of the production was shipped direct to manufacturers in the United States, while the low-grade ore was sold to the Mutual Chemical Company, of Canada, for concentration in their Red Mill, at Black Lake.

The Dominion Mines and Quarries carried on their mining operations at the Montreal Pit, lots 25 and 26, Range II, of Coleraine, continuously throughout the year, and at the old property of the Canadian Chrome Company, lot 16, Range A, of Coleraine during part of the year. At both places the work is done by contract.

Mr. J. V. Bélanger, one of the important operators in the district, mined on lot 19, N.W. range X of Coleraine township, leasing the property from the estate of the late Dr. Reed.

Mr. Bélanger has erected a concentrator consisting of ten stamps and Wilfley tables, driven by an electric motor of 75 H.P.

The Bennett-Martin Asbestos and Chrome Mines, worked during the greater part of the year on lot 28 range I of Ireland township, employing an average of 15 men in their mining operations,

The Mutual Chemical Company of Canada operated their Black Lake concentrator as a custom mill throughout the year very successfully. A short note on this mill was given in our last year's report. It is the mill of the old Black Lake Chrome and Asbestos Company, and is situated on Block A, township of Coleraine, on the line of the Quebec Central Railway, about one and a half mile south-west of the station of Black Lake. This mill which closed down in 1909 was repaired and refitted in 1916, and consists, in the main, of a Blake jaw crusher, 9 x 15 inch, which reduces the ore to 2-inch size; six batteries of 5 stamps each, of 950 lbs, which reduce the ore to pass through 20-mesh screens; seven Wilfley tables which treat the discharge from the stamps.

The capacity of the mill is 70 tons of ore averaging between 12 and 15 per cent chromic oxide, from which approximately two-thirds of the contents are recovered in 50% concentrates.

The Mutual Chemical Company in 1916 built a very complete and modern mill on lot 7 range B of Coleraine, north of little St. François Lake, to treat the ore of the old mines of the American Chrome Company. Short runs were made at various times during the year, but in spite of very active development and prospecting work carried out throughout the year, comparatively little ore has been brought to light, and both mine and mill are closed for the present.

ZINC AND LEAD

The production of zinc and lead ores, in the form of concentrates, amounted to a total tonnage of 4,618 tons valued at $242,778.

The lead concentrate assayed somewhat over 60% metallic lead and the zinc concentrate about 42% zinc.

It may be mentioned that the price of spelter in 1917 varied from a maximum monthly average of 10.3c. in March to a minimum of 7.7 in December, with a rather downward tendency at the end of the year. It may be recalled that the maximum monthly average

price during the previous year 1916 was 18.42c., reached in February.

On the other hand, the price of lead rose steadily during the first six months of the year, from 7.63c. in January to 11.17c. in June, when it started to decrease and was 6.3c. in December, 1917.

The whole of the production of the province of Quebec comes from the district in the vicinity of Notre-Dame-des-Anges, township of Montauban, county of Portneuf, none of the other mines having effected any shipments.

The geology and mode of occurrence of these deposits have been described in detail by Dr. J. A. Bancroft, whose report was published in the report on Mining Operations in the Province of Quebec for 1915. Briefly speaking, in this area, the occurrences of zinc blende and galena are confined to a portion of a zone of highly altered sedimentary rocks of Grenville age, of a length of nearly two miles and a strike that varies from N. 10° to 35E. The rocks dip steeply toward the south-east, and the belt extends across lots 322-327 range I, Price, and lots 39-45 range I, S.W. and into block "C" range II S.W., of Montauban township. Originally these rocks were sandstones and impure dolomitic limestones. Through processes of thermal metamorphism, the sandstones have been changed into paragneisses, quartzites and mica-schists; the limestones have been almost completely converted into tremolite, diopside, phlogopite, actinolite. Zinc blende, together with less amounts of galena and pyrrhotite, and a few scattered particles of pyrite and chalcopyrite, are irregularly disseminated through portions of the altered band of limestone. In those portions of the band that have been almost completely changed to tremolite and diopside, pockets of very rich ore occur. These pockets vary in size from a small nest to masses that will yield several hundred tons of ore which may carry 40 to 52% of zinc and a few per cent of lead.

As to the values of the ores the following paragraph, taken from Dr. Bancroft's report, on the results of the development work done two years ago, in one of the mines, gives a good idea of the metallic contents:[1]

"In the course of this development work, 6,958 tons of ore, with an average contents of 13% of zinc, 9% of iron and 3% of lead have been passed through the remodelled mill that originally had

[1]See Mining Operations for the year 1915.

been erected by Mr. Tétreault. This ore yielded 1,225 tons of zinc concentrate carrying 42% of zinc, 10% of iron and 4% of lead; also 270 tons of lead concentrate, with an average content of 63% lead, 10% iron, 8% of zinc, and carrying 60 ozs. of silver, and about $10 in gold per ton of 2,000 pounds. It would seem to be a conservative estimate that on June 1st, 1916, about 50,000 tons of ore of similar average grade to that milled had been blocked out in the mine."

The Zinc Company, Limited, was the heaviest shipper of ore during the year 1917. The main shaft is on the line between lots 39 and 40, range I, Montauban township. The inclined shaft was not deepened during this year, but much development work has been carried on. As the workings now stand the shaft is down 254 feet on an inclination of 58°. Level T is 20 feet below the collar; first level at 85 feet, runs 400 feet to the south on a sinuous course, second level at 154 feet has been driven 900 feet and at the south end, there is a cross-cut 100 feet long; the third level, at 254 feet, has been driven on a sinuous course towards north to the limit of the property, and about 130 feet toward the south; moreover, a long cross-cut of 175 feet was driven towards the east, and another drift 122 feet to the south off this cross-cut. During the year some 20 diamond drill holes were bored at the different levels searching for ore.

The operations at this mine have been continuous throughout the year, as well as at the mill. This mill has been producing for over a year and is giving full satisfaction. It was built after a long series of experimentation, as the ore is rather complex and does not yield to an easy treatment. It has a feed capacity of 200 tons a day.

The ore is first roughly crushed in a Blake crusher, opening of jaws 20 by 16 inches; then it goes through a ball mill; hydraulic classifier which is a Diester cone classifier; Butchard tables; Diester tables; a standard Mineral Separation installation, using pine oil and sulphuric acid.

Some of the zinc concentrate is treated at a zinc oxide plant which the Zinc Company has erected at the station of Notre-Dame-des-Anges, on the C.N. Railway. The capacity of the plant is 20 tons of ore a day. The installation consists of a dryer, a magnetic separator, for the elimination of the pyrrhotite and iron minerals; an Edwards roasting kiln, 60 feet long and ten feet wide. After

roasting, the ore is cooled on a concrete floor, then crushed, or broken up, in a concrete mixer, in which it is mixed with powdered coal and then charged into the oxidizing furnace. This is a square kiln, with four compartments, through which passes a current of air for the oxidation. The zinc dust driven by the current of air is then collected in high canvas flues, forty feet high, of which there are ninety-six. The zinc dust remains in the flues while the gases escape through the meshes of the canvas. The zinc white is supplied to the paint trade.

The Tétreault mine, which is on lot 40 range I, Montauban township, immediately adjoins the mine of the Zinc Company Limited. It was worked during the greater part of the year. The workings, to date, consist of a vertical shaft, some 80 feet in depth; at 54 feet, there is a cross-cut driven towards the east 77 feet long; from each side of the cross-cut, two drifts have been driven, to the south 175 feet, and to the north 60 feet. Near the end of the south drift there are two cross-cuts, 75 feet towards the west and 30 feet to the east. In the north drift only one cross-cut, driven about 50 feet to the east. The last two drifts, to the east, end in gneiss. The ore produced in 1917 was stoped between the 54 feet level and the surface. The main stope is 150 feet long and 18 feet wide.

The ore is treated in a mill in which the Joplin practice has been adopted, that is to say jigs and tables in the main.

The concentrate is dried in a rotary dryer and passed through a magnetic separator to eliminate the iron minerals.

None of the other properties in the Montauban district were worked during 1917. The Montauban Mining Syndicate's mine, on lot 43 range I, S.W. was idle all year. No machinery has yet been installed in the mill building which was erected in 1916.

No work was carried on by the Oka Gold and Lead Mining Company, which was mentioned in our report for 1916.

The Calumet Zinc and Lead Company, organized to work properties on Calumet Island, went into liquidation some two years ago, and nothing has been done in that district since that time. The concentration plant which had been erected in 1912, was destroyed by fire during the latter part of 1916.

In Gaspé the work of development on the deposits of the head-waters of the Grand Cascapedia river was actively carried on by

Messrs Lyall, Maher & Beidelman, who organized the Federal Zinc and Lead Company. A geological study of the deposits was undertaken for the Quebec Mines Branch, by Mr. A. Mailhiot, and the results of his field work are presented in his report which is given further on.

Some work was also done on a deposit of lead ores situated in the unsurveyed part of the township of Christie, on the West branch of the Marsouins river. A company was organized to take over and work this property, the "Compagnie Minière de Marsouins," with head office at Ste-Anne-des-Monts, County of Gaspé.

MOLYBDENITE

The Quebec molybdenite industry during 1917 has made much greater progress than the figures of production indicate. Much of the work done during the year, exploration, diamond drilling and development of the concentration methods, is not reflected in these figures, but will, without doubt, show prominently in the 1918 production.

The total amount of molybdenite produced in the province of Quebec was 226,739 lbs, valued at $238,096. This comprises various grades of concentrate, some of which went as high as 95%; but most of the molybdenite marketed assayed 75% and over.

Owing to the keen need for molybdenite which has prevailed for the last two years for war purposes, the whole of the Canadian production of molybdenite was taken by the Imperial Munitions Board for the British Government, at a set price of 105 shillings per unit of molybdenite, delivered in England, which corresponds to $1.00 a lb. in Canada. Exportation to other countries were forbidden.

As a result of these conditions molybdenite was quoted at the regulation price of $1.00 a lb. in Canada, while the price in the United States was rising to $2.50 and more a lb. The important feature of this state of things was that some deposits which could have been made to pay with molybdenite at $2.50 were left idle, as they could not be worked profitably for the price of $1.00 set by the Imperial Munitions Board.

In January 1918, the Canadian Government decided to allow exports of molybdenite to United States and France, to approved

consignees, under license. For this it is necessary to obtain a license to export, from the Commissioner of Customs, Ottawa, and if the export is to the United States, a license to import must be obtained from the War Trade Board, Bureau of Imports, Washington.

This will in all probability stimulate prospecting, and the opening of small properties, which could not make ends meet at the price of $1.00 a lb.

In April 1918, the price of molybdenite in United States, as quoted by the *Engineering and Mining Journal*, was $1.80 a lb.

In May 1917, the Moss Mine near Quyon which had been developed with such good results in 1916, by the Canadian-Wood Molybdenite Company, was acquired by a syndicate, representing strong United States interests, and the Dominion Molybdenite Company was organized, capitalized at $5,000,000, to operate it. Since they have taken hold of this property, a great deal of work has been done.

From June to October, 12,000 feet of diamond drill holes were put down, under contract, by the E. J. Longyear Company, who are probably the largest contractors in the world in diamond drilling. The results of this exploration work are said to have been very satisfactory and a large reserve of ore has been blocked out.

The main pit of the mine crosses the line between lots 9 and 10, range VII of Onslow township. At present the work is done by the open cast method, the excavation measuring 170 feet by 75 feet, and about 60 feet in depth. The ore is hoisted to the surface by boom-derricks and dumped into bins, from which it is drawn to be hauled to the mill.

At present only just enough ore is mined to supply the concentrator, for this method of mining is only temporary and will soon be replaced by the "Milling" or "Glory hole" method.

The main shaft being sunk in preparation of the new method, is now (April 1918) down 150 feet, on an incline of 70°. At a depth of 175 feet the first level will be started and a loading pocket of a capacity of 300 tons will be installed. A cross-cut will be driven to intersect the ore body, lateral development will be made and raises will be driven to the bottom of the open cut.

Underground development will be carried on at the same time, preparatory to stoping.

Another shaft is being sunk on No. 4 deposit. It is 65 feet deep on an inclination of 60°.

While diamond drilling was going on at the mine, extensive experiments were carried on on the concentration of the ore. The Wood flotation machines put in by the Canadian-Wood Molybdenite Company, gave a concentrate of comparative high grade, but a low recovery. After elaborate series of tests the Callow Pneumatic Flotation Process was adopted, and a mill capable of treating 150 tons of feed ore per 24 hours was put up. The results have been entirely satisfactory, both from the standpoint of recovery and of the grade of the concentrate. The mill practice is as follows:— from the coarse rock bin, the ore passes over a grizzly, the oversize going to a 10″ x 20″ crusher and the undersize to a 9″ x 16″. The crushed rock is stored in a 200 ton bin, from which it is fed to a Marcy mill. From the mill it goes to a Dorr Duplex classifier, then to four Callow roughers, which effect a first separation into concentrate and tailing, the latter going to the waste dump. The concentrate then goes to two Callow cleaners, which separate it into head and middling, the latter returning to the roughers, making thereby a closed circuit. The concentrate is dewatered, dried, and sampled.

During the year 1917 practically the whole production of the Quyon mine was taken by the Imperial Munitions Board.

Several prospects in the region north of the Ottawa river were worked during the year, and several lots of ore were shipped to the Mines Branch ore dressing laboratory for treatment. The following reported having worked on molybdenite prospects.:—

Ed. Chaput, Eardley township, lot 1, range VII.

H. A. Bertram, Clarendon township, lots 4 and 5, range XII.

M. L. Foley, Onslow township, lot 10, range VII.

Aldfield Syndicate, Aldfield township, lots 1, 2 and 3, ranges IV and V.

Chas. G. Ross, Masham township, lot 58, range IX; lot 57, range X.

Standard Molybdenite Company, Egan township, lots 11 and 12, range III.

Weldon C. Young, Huddersfield township, lots 21 and 22, range V.

Dominion Molybdenite Co., Limited.—Open stope, lot 10, range VII, Onslow township.

Dominion Molybdenite Co., Limited, Quyon, Que.—Concentration plant.

Wood Molybdenite Company, Huddersfield township, lots 23, 24 and 25, range VIII.

L. N. Benjamin, La Corne township, lots 1 and 2, range 1, Abitibi district.

The Wood Molybdenite Company have acquired a very promising prospect in range VIII of Huddersfield, and have actively pushed its development in 1917. They have now a small mill erected for the concentration of the richer ore.

Dr. J. A. Bancroft was commissioned by the Quebec Mines Branch to make an examination of the mode of occurrence of the molybdenite deposits in Huddersfield and his report is given below.

Mr. L. N. Benjamin and associates carried on development work in La Corne township and the results are said to have been very satisfactory. The main work has been performed on lot 1, range I of La Corne township. This occurrence is situated some 20 miles, in a straight line, south of the town of Amos and 2½ miles east of the Harricana river. The deposit appears to be connected with intrusions of granites, cutting mica schists, and the molybdenite is found in a pegmatitic phase of the granite and in the adjoining schist.

According to the report received from the operators, much stripping has been done and a shaft has been put down, following the mineralized zone which dips 40° to 70° to the south east. The shaft in December 1917 was down 42 feet, the intention being to sink it to 100 feet before drifting. Some 120 tons of ore has been extracted, which is said to run in the vicinity of 4% molybdenite. None was shipped except samples for experimental purposes. The operators are considering the construction of a small concentrator.

The Molybdenite Deposits in the Vicinity of Big Squaw Lake, Huddersfield Township, Pontiac County, P.Q.

By J. Austen Bancroft.

Towards the close of last September, the writer spent a few days in the northern portions of lots 18 to 28, range VIII of Huddersfield Township where, in the vicinity of Big Squaw Lake, certain occurrences of molybdenite had been discovered. Considerable prospecting had been done on these lots, and on that portion

of lot 24 which lies immediately north of the most eastern end of Big Squaw Lake, some deposits of molybdenite were being opened up by the Wood Molybdenite Company of Ottawa who were also erecting a small concentrating mill on the shore of the lake near the boundary line between lots 24 and 25.

Situated within the most northerly range of this township, and extending northward into unsurveyed lands, Big Squaw Lake discharges into Little Squaw Lake and thence into the Pickanock river, an important tributary which flows into the Gatineau river from the west. It is about 36 miles by road from the town of Shawville which lies north of the Ottawa river and 46.3 miles westward from Ottawa city on the Ottawa and Waltham branch of the Canadian Pacific Railway. In a straight line, the Squaw Lake molybdenite deposits are about 35 miles N.N.W. of the "Moss" or "Wood" mine which is situated on lots 9 and 10, range VII of Onslow Township, about 3 miles north of Quyon Station which is 32.5 miles west of Ottawa city. During the past two years the annual produc-

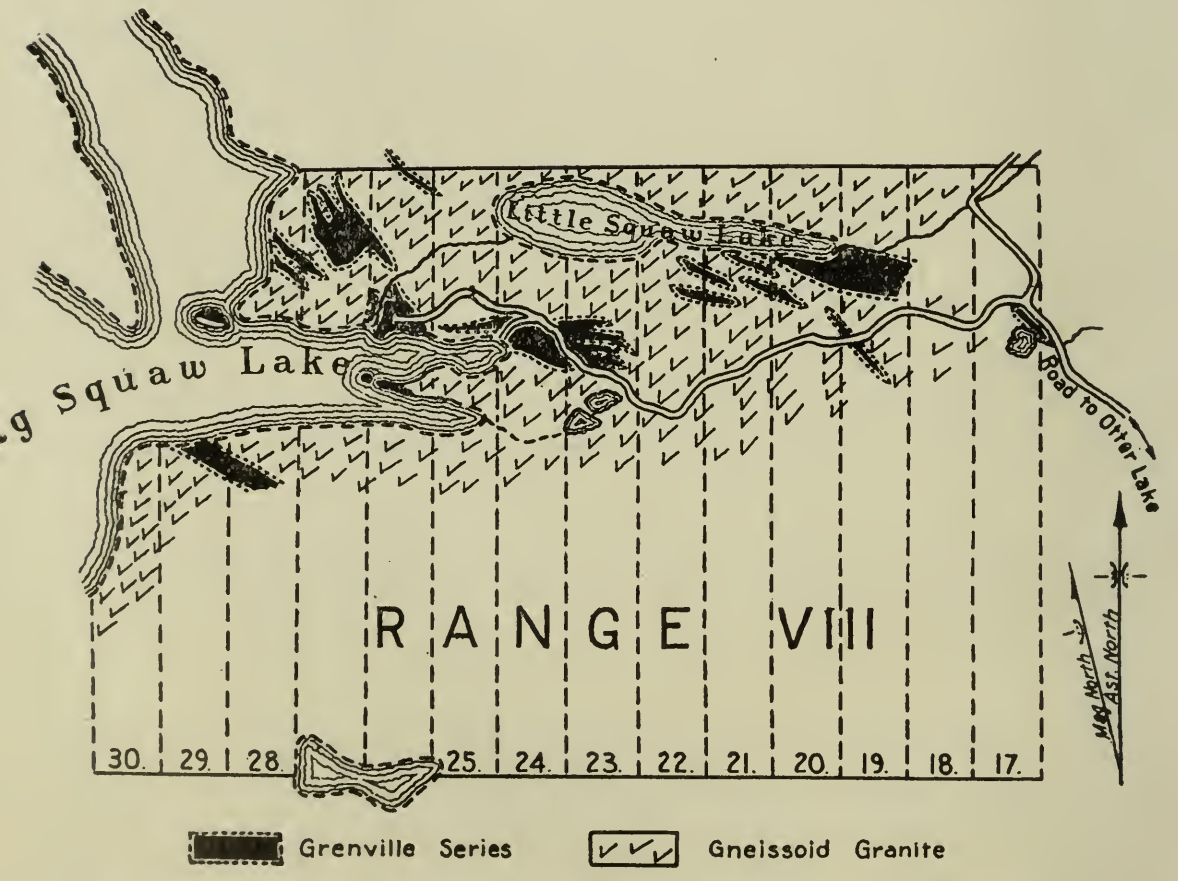

Fig. 1—Sketch of geological outlines, Range VIII, Huddersfield Township.

tion of molybdenite at the "Moss" or "Wood" mine has exceeded that of any other individual mine in the world.

The township of Huddersfield was surveyed in 1870 but, at least in range VIII, apparently the lot lines were not run and both as regards their position and their outlines, the lakes and rivers are not correctly shown on existing maps. With the exception of the small area of land that has been cleared in the course of prospecting operations, lots 18 to 28, range VIII, are wooded. The small map (Fig. 1) accompanying the present report is merely a diagramatic sketch showing approximately the position of the lakes and the streams and the general geological relations within the area examined; the position of the roads was roughly determined by means of a prismatic compass and pacing.

General Geology.—The area is underlain by igneous gneisses which for the most part have the composition of granites and quartz syenites and which here and there enclose bands of intensely metamorphosed sedimentary rocks. These altered sedimentary rocks, including crystalline limestones, paragneisses and quartzites, occupy narrow areas which are elongated in the direction of the strike of the foliation of the igneous gneisses, which here varies from E.-W. to N.W.-S.E. They are merely shreds or remnants of the thick series of the Pre-Cambrian sedimentary rocks, known as the Grenville Series, which was invaded and more or less torn to pieces by the vast batholiths of granitoid gneisses. Erosion has truncated deeply the reservoirs within which the igneous gneisses cooled beneath a thick roof of Grenville Series; the bands of altered sedimentary rocks are but the tattered ends of roof-curtains or *lits* of limestones, sandstones, etc., which were completely recrystallized and, in places, partially digested by the magma.

The limestones are coarsely crystalline and either white or salmon-pink in colour. Usually interbanded with paragneisses and quartzites, the limestone bands when traced along the strike are frequently found to pinch and swell, disappear and re-appear in a most irregular manner. All the limestones within the area contain more or less abundantly disseminated grains of one or more of the following minerals that have been developed under the influence of contact metamorphism,—diopside, chondrodite, phlogopite, scapolite, hornblende, serpentine, apatite, sphene and a few flakes of graphite. Grains of chondrodite are especially abundant in some of

the limestone bands and a comparative study of thin sections shows that it has been through the alteration of chondridite grains to serpentine that the serpentine-bearing limestones have been developed, which are so typically exposed in the vicinity of the eastern end of Little Squaw Lake. In places, certain bands which were originally limestones have been completely converted into coarsely crystalline diopside, with some phlogopite, hornblende, scapolite, quartz, etc.

The paragneisses with which the limestones are interbanded are light to dark gray in colour and vary much in their composition; for the most part, they are fine to medium-grained quartzose biotite- or pyroxene-rich gneisses which, because of the presence of irregularly disseminated grains of pyrite or pyrrhotite within them, frequently display rusty streaks on their weathered surfaces. Some bands of these gneisses carry abundantly disseminated flakes of graphite as, for example, the thick bands of graphite-bearing gneiss which cross lot 24 a few yards north of the group of prospect pits. In general the paragneisses originally were sandstones or shales which in the course of their recrystallization have had their original composition more or less modified by the *diffusion* of solutions from the magma which, on cooling, crystallized to form the granitoid gneisses. When examined in thin section under the microscope, specimens from a band of medium-grained paragneiss of light grey colour from one of the small open cuts (B. in Fig. II) on lot 24 was found to be composed of a mosaic of irregular quartz grains, scattered through which are numerous grains of diopside, scapolite, sphene and abundantly disseminated grains of pyrrhotite; it is highly probable that this paragneiss which now possesses a somewhat unusual mineralogical composition was originally a calcareous sandstone. Quartzites were only observed in some of the prospecting trenches on lot 27 where narrow bands of this rock are interbanded with the crystalline limestones and paragneisses.

Not only are the long and narrow remnants of the altered sedimentary rocks enclosed within the gneissoid granites in such a manner that their dip and strike corresponds to that of the foliation of the igneous gneisses, but they have been torn apart by numerous irregular bands and tongues of the latter which usually were injected in *lit par lit* relationship. Locally, both the granite gneisses and the bands of metamorphosed sedimentary rocks are traversed by narrow stringers and dykes of pegmatite which ramify in all directions.

Mode of Occurrence and Origin of the Molybdenite Deposits.— The occurrences of molybdenite within this area have been developed under the influence of processes of intense contact metamorphism. In the vicinity of some of the contacts between the intrusive granitoid gneisses and the metamorphosed sedimentary rocks, some bands of the latter which originally were pure limestones and possibly other calcareous sedimentary rocks have not only been converted into an assemblage of variably coarse grains of dark green pyroxene, phlogopite (brown mica), scapolite, sphene, apatite, calcite and quartz, but, in a few places, relatively small portions of some of these bands have been irregularly impregnated with molybdenite, pyrrhotite, pyrite and occasionally a few grains of purple fluorite; occasionally pyroxene is present almost to the exclusion of the other minerals mentioned. In some places where this mineralization has taken place, the altered sedimentary rocks are traversed by narrow irregular dykes of pegmatite which also occasionally carry a few scattered flakes of molybdenite and grains of the iron sulphides. In places near these contacts, the granitoid gneisses contain the metamorphosed equivalents of small inclusions or fragments, invariably of greater length than width, of the calcareous sediments, some of which are especially rich in molybdenite.

The occurrences of molybdenite are plainly the result of mineralizing fluids and probably gases which emanated from the cooling granitoid magma and permeated portions of the then crystallizing sedimentary rocks. The mineral associations as well as the geological relations of these molybdenite occurrences indicate that they developed at great depth and under conditions of relatively high temperature and great pressure.

As would be expected from the above description of their mode of occurrence and origin, the molybdenite deposits within this area are extremely irregular and erratic. At numerous places where the geological conditions are such as have been described above, a few irregularly scattered flakes of molybdenite have been found, while at several points on that portion of lot 24 to the southeast of the head of the most eastern bay of Big Squaw Lake, some spectacular deposits of molybdenite have been discovered. Not sufficient prospecting has been done to show whether these deposits on lot 24 can be worked at a profit. So irregular is the molybdenite content of the rock that one can rarely foretell what the succeeding shot will disclose; it may be that the rock immediately

beneath will be barren, it may contain a few irregularly scattered flakes of molybdenite, or portions of it may carry as high as 30% of molybdenite crystals which, individually, rarely exceed more than half an inch across.

Prospectors engaged in searching for molybdenite within this and adjacent areas should examine carefully all areas and bands of intensely metamorphosed sedimentary rocks and especially those that originally were impure limestones and allied rocks; nor should they overlook the possibility that within some of the pegmatite dykes or pegmatitic phases of the granite gneisses, workable deposits of this mineral may be found.

Detailed descriptions of these molybdenite occurrences and of the prospecting work that had been done on them are now given:

Lots 19 to 26 (inclusive), Range VIII.—These lots have been crown granted to the Wood Molybdenite Co., of Ottawa, who were erecting a small concentrating mill on the northern shore and near the head of the most eastern bay of Big Squaw Lake in the vicinity of the boundary line between lots 24 and 25. They had also constructed a waggon road through the bush from this mill to join the Pickanock road on lot 17.

Within 150 to 200 yards from the shore of the lake, on lots 24 and 25, the land rises gradually to elevations that vary from about 40 to 60 feet above the lake. The majority of the molybdenite occurrences that have been discovered on lots 19 to 26 are situated on lot 24 where on the slope of the hill that rises from the lake, a narrow ragged area of paragneisses, enclosing a few streaks of highly altered impure limestones, lies within gneissoid granites. Though locally much contorted and in many places torn apart by bands or long irregular bodies of the igneous gneisses, these altered sedimentary rocks possess a maximum width of a little more than 100 yards and striking toward the northwest, usually dip from 40° to 50° toward the south, but from point to point their dip varies from 15° to 80°. If traced from lot 24 along their strike on to either the adjacent portions of lot 23 or lot 25, these sedimentary bands fray out into narrower bands each of which pinches out within the gneissoid granites.

Fig. 2 has been prepared to show the approximate relative positions of the open cuts and trenches that had been excavated on lots 23 and 24 at the time the property was examined by the writer.

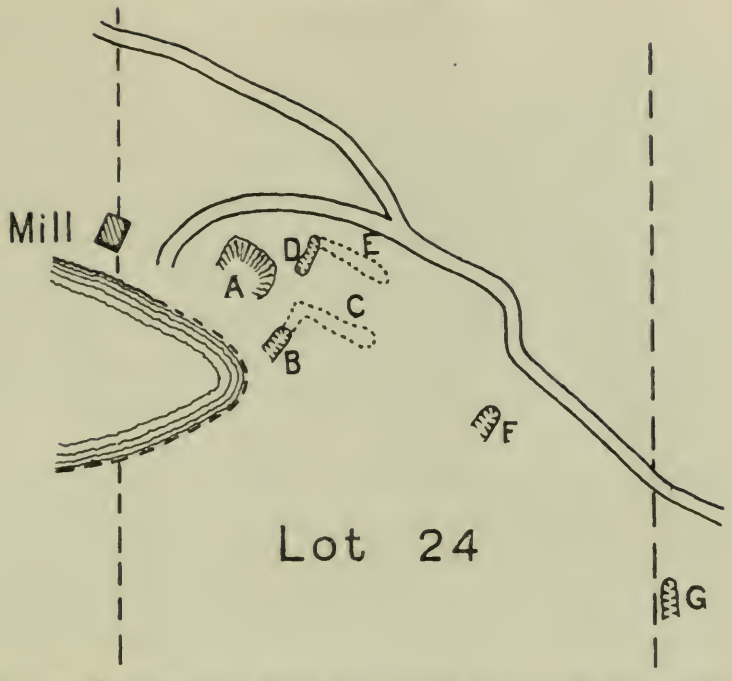

Fig. 2—Molybdenite workings on lots 23 and 24, range VIII, Huddersfield township.

In this figure, A is an irregular shallow open cut which had been extended for about 40 feet into the foot of the hill, the slope of which was such that the inner portion of the face of the open cut did not exceed 12 feet in height; at its entrance, this open cut was about 75 feet wide. This excavation had been made in intensely metamorphosed impure limestones which are here intruded by a very irregular body of medium grained gneissoid granite of quartz-syenite, which in turn is cut by a few ramifying dykes of pegmatite that have the composition of a quartz-bearing augite syenite and do not exceed a foot in width. What were originally impure limestones and probably other calcareous sediments are now chiefly composed of dark green pyroxene which in places is very coarsely crystallized together with grains of scapolite, apatite, calcite, fluorite, pyrrhotite, pyrite, occasionally a few flakes of phlogopite, and in some portions of this recrystallized mass, irregularly disseminated flakes and crystals of molybdenite are present. In portions of the recrystallized mass, calcite is the predominant mineral; in other portions this mineral is absent. The light gray granitoid gneiss, which is exposed in the central portion of the floor of the open cut and towards its eastern wall, contains a few long irregular fragments of the impure limestones which have been chiefly altered into streaks of dark pyroxene and which in some instances are very rich in molybdenite with pyrrhotite, pyrite and fluorite.

B, is an open cut which had been extended horizontally into the foot of the hill for 35 feet; its working face was 14 feet in height. This excavation exposes a medium-grained gray granitoid gneiss which strikes N. 60° W. and dips about 50° toward the southwest and which, parallel to its foliation, includes a few narrow irregular streaks, rich in pyroxene, sphene, scapolite, quartz, and occasionally calcite, apatite and fluorite, which represent remnants of highly altered and partially digested calcareous sedimentary rocks. The gneisses are traversed by a few narrow irregularly pegmatitic stringers. Towards the inner portion of the open cut the gneissoid granites pass beneath a capping of dark gneissoid, pyroxene-rich re-crystallized calcareous sediments which at the working face was about two feet thick, and which contained irregularly disseminated flakes and crystals of molybdenite. It is said that near its mouth this open cut passed through a band of altered impure limestones, nearly two feet thick which was exceptionally rich in molybdenite but which had been covered up by rubbish on the floor of the cut. The walls of this cut show practically no molybdenite except within the capping which has been referred to.

C, is a trench or stripping 8 to 12 feet in width, and 135 feet in length by which a thin overburden had been removed, exposing dark gneissoid pyroxene-rich altered sedimentary rocks which, in a few places, contain irregularly scattered crystals of molybdenite, up to a half an inch across.

D, is a trench, 50 feet long, 3 feet wide and with a maximum depth of 3½ feet within which rusty paragneisses and metamorphosed impure limestones were exposed, but no molybdenite was observed within these rocks. At the junction between a band of rusty gneiss and a band of altered limestone, there is a cavity, 3 feet in length, 2 feet in width and 2 to 3 feet in depth into which apatite crystals projected, the largest of which was five inches long and nearly two inches thick.

E, is an irregular trench with a length of about 125 feet, an average width of 8 feet and a maximum depth of 3½ feet. It exposes rusty paragneisses interbanded with which are some irregular streaks of metamorphosed impure limestones similar to those previously described. Blasts have been discharged at a few points where the bed rock carries molybdenite, pyrrhotite and pyrite. About midway in the length of the trench there is an irregular pyroxene-rich band which varies up to two feet in width, within

which flakes and small crystals of molybdenite are especially abundant.

F, is a small open cut near the top of the hill which had been driven in to where its working face was 7 feet high. Bands of paragneisses and narrow streaks of calcite and coarse grains and crystals of dark green pyroxene alternate with irregular bands of gneissoid granite. Some of the pyroxene-rich bands contain much pyrrhotite, pyrite and disseminated flakes and scattered crystals of molybdenite, some of which are slightly more than an inch across. Some rich fragments of molybdenite ore have been taken from this opening.

Apparently on lot 23 but near its boundary with lot 24, G is an open cut, 45 feet long, 10 feet wide and with a maximum width of 9 feet which had been excavated in light gray quartzose paragneisses intruded by irregular bands of gneissoid granite some of which are of pegmatitic character. In part, the paragneisses contain abundantly disseminated grains of pyrrhotite and pyrite. At the contact between the paragneisses and one of the bands of pegmatite, a stringer of practically solid pyrrhotite and pyrite attained a width of about 3 inches. No molybdenite was observed in the rocks exposed by this open cut.

About 20 feet back of the cook house which has been erected approximately 75 yards north of the mill, there is a small opening at a contact between highly altered impure limestone and rusty paragneiss both of which are traversed by narrow bands of gneissoid granite. Within an area of a few square feet the altered sedimentary rocks have been irregularly impregnated with disseminated grains of the iron sulphides and flakes of molybdenite.

The foundations for the concentrating mill were excavated in a light-gray medium-grained granitoid gneiss chiefly composed of a mosaic of orthoclase and microcline with flakes of brownish-black mica and grains of sphene, pyrrhotite, magnetite and a little quartz. Within this rock, which in composition is a quartz-syenite, a few narrow pyroxene-rich and quartzose bands were encountered that occasionally contained molybdenite.

On an old winter road which lies to the north of the road that has recently been constructed across these lots, and apparently in the vicinity of the boundary between lots 20 and 21, the granitoid gneisses enclose narrow bands of paragneisses. An irregular portion

of one the these bands of paragneisses, with a length of not more than 10 or 12 feet and a maximum width of two feet, contains very small disseminated flakes of molybdenite with grains of pyrite and pyrrhotite.

Of the discoveries that had been made on these lots, those on lot 24 which have been exposed in the open cut A and in trenches C and E displayed the richest molybdenite ore, and were worthy of further prospecting effort. Because of the great volume of unmineralized rock that would have to be handled, any attempt to work these separate and irregularly mineralized patches on the lower slopes of this hillside by excavating one large open cut would obviously prove to be most unprofitable. In September, 1917, when the writer visited the property, about 75 tons of ore had been accumulated in piles as a result of the work done in open cuts A and B. Although small portions of this ore could be selected which would be very rich, it was roughly estimated that in all it probably would not average more than between one and two per cent of molybdenite. No shipments had been made.

Lot 27, Range VIII.—That portion of this lot which lies to the north of the most eastern bay of the Squaw Lake has been staked in the name of P. B. Moyle, of Quyon, P.Q. About 300 yards north of the shore of this eastern arm of the lake, there is an irregular area underlain by crystalline limestones, paragneisses and a few narrow bands of quartzites. Striking N.W. to S.E., and dipping from 40° to 80° (usually 50° to 60°) toward the S.W., these highly altered sedimentary rocks of the Grenville Series are traversed parallel to their strike by bands of intrusive gneissoid granites and in a few places are cut by narrow pegmatite dykes which ramify in all directions. The crystalline limestones are either white or salmon-pink in colour and frequently contain abundantly disseminated grains of green diopside, yellow chondrodite and small flakes of the brown mica, phlogopite.

Within the area occupied by this remnant of the Grenville Series, considerable prospecting work has been done in searching for deposits of molybdenite. The bed-rock has been exposed in trenches with a total length of about 900 feet; usually from one to four feet in depth, the most of these trenches are extended across the strike of the underlying rocks. In places, the more massive beds of limestone were found to have weathered with an irregularly cavernous

surface, one opening having been thus developed with a length of 8 feet, a width of 2 feet and a depth of 5 feet on the dip slope. At a number of points within the trenches and especially where the surface of the gneisses or limestones displayed irregular rusty streaks or bands caused by the presence within them of disseminated grains of pyrite and pyrrhotite some blasting has been done.

In addition to the trenches, three other openings have been made in bed-rock, one of which is 9 feet deep while two are each four feet in depth. The first mentioned is the most easterly and has been sunk at the contact between bands of crystalline limestones and an overlying band of paragneiss, the series here striking N.W., and dipping 50° to 60° toward the S.W. Both the limestones and the paragneiss are cut by a narrow, irregular pegmatite dyke which is well exposed on the eastern wall of the pit but towards the west it pinches out within the width of the pit. The pegmatite is chiefly composed of coarse feldspar, a few flakes of biotite some of which are a half an inch across, and a very few crystals of hornblende. In a few places adjacent to the pegmatite dyke, narrow streaks or nests within both the limestone and the paragneiss have been impregnated with disseminated grains of pyrite and pyrrhotite and an occasional flake of molybdenite.

About 45 yards to the westward and at the southern end of one of the trenches, an irregular opening has been made to a depth of 4 feet in gneissoid granite which includes a few narrow bands of highly altered sedimentary rocks that contain scattered grains of pyrite and pyrrhotite.

Toward the northwest and about 45 yards away, a pit, 12 ft. x 15 ft., has been sunk to a depth of 4 feet. This opening exposes medium-grained, light grey igneous gneiss that contains a few inclusions of altered limestones, some of which occur as nests or streaks of coarsely crystalline calcite, while others have been almost completely altered to dark, coarse-grained pyroxene with grains of pyrite, pyrrhotite and a very few scattered flakes of molybdenite. The largest of these mineralized inclusions is exposed on the eastern wall of the pit where with a maximum width of eight inches it descends two feet from the surface. Judging from the dump, small portions of one or more of these inclusions encountered in sinking the pit must have been chiefly composed of pyrite and pyrrhotite with a few flakes of molybdenite. In the northeastern corner of the pit, the grey gneiss is cut by an irregular dykelet of pegmatite

composed of feldspar, with scattered grains of pyrite and an occasional flake of molybdenite.

No discoveries have been made in any of the trenches or pits on lot 27 that would warrant the continuation of prospecting work within them.

GOLD AND SILVER

No precious metal deposits are at present on a producing basis in the province of Quebec, and the output of gold and silver represents the content in these metals of the copper-sulphur ores of the Eastern townships and of the zinc-lead ores of the county of Portneuf.

During the year 1917, the gold and silver contents of these ores were as follows according to the figures received direct from the producers: gold 1,116 ounces, valued at $22,570; silver, ounces 96,620, valued at $78,880.

At one time the alluvial gold industry was very active in the valleys of the Chaudière river and its tributaries. Gold has been observed in this basin from Lake Mégantic to St. Joseph, a distance of 50 miles in an air line, and between the years 1847 and 1893, it has been estimated that between two and three million dollars worth of gold was produced by various companies who operated in this field.

In 1910 work was resumed, on a comparatively large scale, for the hydraulic working of some of these gold deposits in the Rigaud-Vaudreuil seigneurie,[1] and work was carried on for three seasons, but the results were not satisfactory, in a great measure owing to bad management. Since the cessation of the activities of this last company, some panning has been carried on by individuals, frequently unlawfully, from whom it is practically impossible to obtain returns of production. In any event such figures would be small.

It may be mentioned that a report of panning 4 ozs. of gold was received from Mr. P. Turcotte, of West Broughton, who holds a mining license on the south half of lot 13, range XV. of Leeds township.

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[1]See Report of Mining Operations in the Province of Quebec for 1910, and subsequent years.

Molybdenite.—Sorting platform on Benjamin property, lots 1 and 2, range I, township of La Corne, Abitibi.

The Martin Gold Mining Co.—Headframe and stampmill, block A, range IX, township of Dubuisson, Abitibi.

In the Abitibi region report of development work was received from the Martin Gold Mining Co., Limited, who took over the mining lands of O. Leblanc, parts of lots 36 and 37 range VIII and block "A" range IX, of Dubuisson township. A 7 x 9 shaft was sunk to a depth of 26 feet, and at the end of the year a small stamp mill was being erected on the property.

Work was also done on the claims of Jos. F. Stabell, also in Dubuisson township.

MAGNESITE

During the year 1917, the magnesite marketed by operators in the province of Quebec totalled 58,340 tons, valued at $729,025. This quantity represents crude, calcined or caustic magnesite, and dead burned or sintered magnesite. Had the magnesite been all marketed as crude the tonnage would have been about 64,000 tons.

The Scottish-Canadian Magnesite Company, whose quarry is situated on lot 15 range XI of Grenville, worked steadily all the year round. The quarry is now connected with the C.P.R. line by a narrow gauge railway, 13 miles, which joins the main line at the junction point Magnesite, five miles east of Calumet station.

The main excavation measures 150 feet by 30 feet, and the depth is approximately 40 feet. The equipment is adequate for a production of over 150 tons a day.

Some of the ore is shipped to Hull, to the plant of the Canada Cement Company, where, by an agreement between the two companies, the Scottish-Canadian Magnesite Company is using the cement kilns for the production of dead-burned or sintered magnesite with very good results. For this purpose, the raw magnesite is crushed in gyratory crusher and mixed with a certain proportion of iron ore, so that the sintered product contains 8% of iron oxide. The iron ore used is magnetite from the Forsyth mine, at Ironside, near Hull. From the crusher the mixture goes to a ball mill. It is then fed into a cement kiln in which the temperature reaches 2400° F. The sintered magnesia is in nodules of one inch diameter and less. After cooling it is put in bags.

The North American Magnesite Company operated their quarry, known as the McPhee mine on lot 15 range IX of Grenville. They also worked the Dobbie property, lot 13 range I of

Harrington township, which they leased from the International Magnesite Company. The quarry on the McPhee lot is now 150 feet by 80 to 90 feet, and has a depth of approximately 50 feet. A electric power line from Calumet to the quarry is under construction.

There is a calcining kiln at the mine, producing caustic magnesite which is used in the chemical trade. The product of the kiln, 10 tons a day, is shipped to the United States.

The North American Magnesite Company have rented the Vulcan mill of the Canada Cement Company, at Longue-Pointe, and they are now producing dead-burned magnesite. The raw magnesite is mixed with some of the Hull magnetite to supply the bonding medium, as in the case of the operations of the Scottish-Canadian Magnesite Company.

The magnesite deposits of the province of Quebec which are at present worked are situated in the townships of Grenville and of Harrington, county of Argenteuil. Although the knowledge of their existence dates back to the year 1900 when specimens collected by Messrs. McAllister and Boshart were determined by the Geological Survey, it was not before 1907 that "some work was done on a deposit of magnesite, or carbonate of magnesia on N $\frac{1}{2}$ of lot 18 range XI of Grenville, county of Argenteuil. A couple of hundred tons were got out and 35 tons shipped for trial."[1]

Following this beginning a company was organized "The Canadian Magnesite Company" to supply the material to manufacturers of flooring materials, and for the manufacture of carbonic acid for aerated waters. For flooring cement, caustic magnesite, finely ground, is mixed with magnesium chloride, and the mixture known as Sorel cement, sets in a very tough, vitreous layer, much more resisting than the common cement.

In the following year about 65 tons were shipped, and year by year the production increased, although it was a small industry until the cutting off of the source of supply of Austrian magnesite by the war, fixed the attention of users of refractory materials, on the Quebec deposits. In 1915, the shipments attained 16,285 tons. In 1916 they were 53,976, and in 1917, 58,340 tons.

It is undeniable that the development of our magnesite industry is due directly to the war. For refractory purposes, as furnace lining, magnesite brick, there existed a strong prejudice against

[1]Report of Mining Operations in the Province of Quebec during 1917.

the Quebec magnesite owing to its rather high content in lime, 5 to 12% and its lack of cohesion under high temperature. This lack of bonding quality, of which the Austrian magnesite does not suffer, is due to the almost total absence of iron. The Austrian product contains from 5 to 10 per cent of iron oxide, whereas Quebec magnesite is very much lower than this, as a rule not exceeding $1\frac{1}{2}$ per cent. It might be thought that the lack of iron oxide could easily be remedied by the addition of some iron ore, such as limonite, hematite or magnetite, but it appeas that the iron oxide in the Austrian magnesite is in a state of fine division, or dissemination, which cannot easily be duplicated in a mechanical mixture, and that this imparts particularly good bonding qualities when submitted to furnace heat.

After a great deal of experimenting, the Steel Company of Canada, Hamilton, Ont., has evolved a very satisfactory method of using the Grenville magnesite for the bottoms of their open-hearth furnaces.

After calcination of the crude magnesite, it is broken in small pieces, half-inch size, and mixed with 15% of a blast furnace slag containing 15 to 20% iron oxide and 50% lime. The furnace to be lined is heated to a temperature sufficient to melt the slag and the mixture of slag and calcined magnesite is spread over the bottom in thin layers until the required thickness has been attained. During the operation of lining the temperature of the furnace is kept at 2700° F.

From a communication received from the Steel Company of Canada the results are quite equal to those obtained from Austrian magnesite.

As to the walls of steel furnaces, Mr. F. R. McKune, of the Steel Company of Canada has obtained very satisfactory results in using a mixture of dead burned Grenville magnesite, caustic magnesite and magnesium chloride. This mixture forms a plastic mass which can be applied with a trowel to the walls of the furnace and allowed to set for 24 hours. Heat has to be applied gradually. This replaces the magnesite brick of which such walls are usually built.

As to the manufacture of brick from Quebec magnesite, "it has been stated that lime in magnesite will cause the dead-burned article to absorb moisture and to slack to a harmful extent. A

series of tests showed that Canadian dead-burned magnesite carrying as much as 16% of lime does not slack to any extent, even after very fine grinding and prolonged exposure to moist air."[1]

The presence of magnesite in Argenteuil county has been observed, in apparently workable quantities, in the following localities:

Grenville township.—Range VIII, N, lots 11, 12; range VIII, S., lots 11, 12; range IX, lots 13, 15, 16; range X, lots 7, 15; range XI, lots 15, 18.

Grenville Augmentation XI, lot 9.

Harrington township.—Range I, lots 13, 21.

The various deposits in these localities have been described in detail by Dr. M. E. Wilson, in the report published by the Geological Survey of Ottawa, on the "Magnesite deposits of Grenville District," Memoir No. 98, 1917.

The conclusions arrived at by Dr. Wilson as a result of his work on these deposits are reproduced in full.

"Some of the more important results of the study of the character, extent and relationships of the Grenville magnesite deposits briefly stated are as follows:

The deposits are of early Pre-Cambrian age and occur in association with the metamorphosed group of sediments (crystalline limestone, sillimanite garnet gneiss, and quartzite) known as the Grenville series.

All of the deposits so far discovered in the district occur in the major valleys in which stratified marine clay and sand have been deposited. Through this material the deposits outcrop in ridges or groups of ridges up to 1,000 feet in length and 300 feet in width.

The ridges in which the magnesite is found are composed mainly of magnesite, dolomite, serpentine, and diopside. The proportion of magnesite free from dolomite, or dolomite free from magnesite in the deposits, however, is small, these minerals occurring for the most part intimately intermingled in varying proportions.

The deposits have all been so intensely deformed since their formation that masses of serpentine, dolomite, and other variations which they contain have been squeezed out into lenses.

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[1]Roost H. J. Trans, Can. Mining Institute, 1917, page 224.

The study of the character and relationships of the deposits has led to the conclusion that they are of metamorphic origin, and have been formed by the replacement of the limestone member of the Grenville series through the agency of magnesia-rich solutions.

While the magnesite everywhere includes more or less dolomite, diamond drilling and other development work have shown that extensive masses of magnesite are present in which the lime content resulting from the presence of the dolomite averages from 7 to 10 per cent.

A summarized statement of the number of tons of magnesite and magnesite-dolomite in sight in the various properties is as follows:—

Property	Magnesite containing less than 12% CaO Tons	Magnesite-Dolomite containing more than 12% CaO Tons
Lot 13, range I, Harrington Tp....	25,000	8,000
Lot 18, range XI, Grenville Tp....	15,000	6,000
Lot 15, range XI, Grenville Tp....	418,000	186,300
Lot 15, range X, Grenville Tp.....	2,500	4,000
Lot 15, range IX, Grenville Tp....	226,400	279,400
Total.....	686,900	483,700

Of the above total, however, there is approximately 69,000 tons of magnesite on lot 15, range IX, and 10,000 tons on lot 15, range XI, that could not be profitably mined unless a market for magnesite-dolomite was procured.

Since the magnesite and magnesite-dolomite are, on the whole, less resistant to erosion than either the serpentine or the rocks of the Grenville series with which the deposits are associated, it is probable that the outcrops in which the magnesite occurs have little or no relationship to the actual distribution of the magnesite and that extensive masses of magnesite occur underlying the clay flat adjoining the outcrops.

Since the magnesite deposits are generally associated with the rocks of the Grenville series and since these rocks usually underlie

valleys, the most favourable localities for prospecting for magnesite are the valleys, and especially those valleys where limestone and other members of the Grenville series are known to be present.

The occurrence of boulders of magnesite in localities where they could not possibly have been derived from the known occurrences of the material indicates that there are other undiscovered deposits of magnesite in the district."

As we remarked in last year's report on the Mining Operations in the province of Quebec, it is interesting to note that by Dr. Wilson's explanation of their mode of origin these magnesite deposits need not be limited to any definite area of Grenville rocks, and they are liable to occur in any patches of this series, throughout the southern fringe of the vast Laurentian expanse which constitutes the Pre-Cambrian shield, where the replacement process of the magnesia solutions has been sufficiently active to change the limestone into the gradations of magnesian limestone, dolomite and magnesite.

MICA

A marked improvement in the demand for mica, and better prices resulted, in a substantial increase in production in 1917 as compared with the previous year. The figures, as compiled from the returns received at the Quebec Mines Branch, show that 1,531,629 pounds valued at $281,234 were marketed from the mica mines in the province of Quebec during 1917.

It is rather difficult to present systematic statistics of mica production owing to the diversity of products and the divergence in prices. The mica is marketed in several forms, of which the principal ones are thumb-trimmed mica, thin-split mica, scrap mica and pulverized mica.

Scrap mica and pulverized mica bring in from $\frac{1}{2}$ to 2 cents a pound, whereas large sheets of thumb-trimmed mica go as high as $2. a lb.

The thin-split mica, which is split into sheets of one to two thousandths of an inch in thickness, or about the thickness of ordinary paper, represents a further stage or preparation. Only small sheets under 1 by 3 inches, are thin-split, being used for the manufacture of "micanite," which is a plate built up of small thin pieces of mica cemented by shellac and submitted to hydraulic pressure.

Much India mica, which is muscovite, is sold thin-split for mica plates and micanite. The two most current sizes for this purpose are what are called No. 5 and No. 6. The No. 5 India mica corresponds about to our 2 x 3, and the thin-split sold for 50 cents a pound last year. The No. 6 Indian, which equals our 1 x 3 in size, sold for 20 to 30 cents a pound, whereas Canadian thin-split 1 x 3 was 45 cents a pound.

Our figures of production comprise all classes of mica, for it is often difficult to differentiate them from the reports, and in this respect the figures are unsatisfactory. Roughly speaking the figures of value of the production in 1917 can be divided as follows: sheet mica, thumb-trimmed, $155,000; thin and split mica $110,000; scrap and pulverized mica making up the difference. The ruling prices for mica towards the end of the year for standard sizes, thumb-trimmed, were as follows, per pound:

1 x 1 inches	$0.08 to $0.10	2 x 4 inches	$0.60 to $1.00
1 x 2 "	.12 to .16	3 x 5 "	1.30 to 2.00
1 x 3 "	.18 to .30	4 x 6 "	1.70 to 2.50
2 x 3 "	.35 to .55	5 x 8 "	2.25 and over

The main uses of mica in sheets is in the manufacture of electrical machinery. Plates of mica of all sizes, from one square inch to 25 to 30, in area, enter in the construction of dynamos, fuse-boxes, rheostats, electric-light sockets, insulators, fuse-boxes.

Much mica is used in the manufacture of electric self-starters, for automobiles and aeroplanes.

Ground mica is used in the manufacture of wall papers and other decorative papers, also as filler in the manufacture of rubber goods, fireproof paints; in coverings and heat insulating compounds for pipes and boilers, and also as lubricants, both dry and mixed with oil.

It may also be mentioned that a considerable quantity of ground mica is used in the manufacture of phonograph disc records, into the composition of which it enters largely.

Ground mica is sold in the trade under designations of fineness, of which the standard sizes are 10 mesh, 20 mesh, 40 mesh, 60, 100, 160 and 200 mesh. Ground mica, 60 mesh, was quoted $40 a ton at the end of the year.

Mica is used as glazing material for the purpose of transmission of light, in places where glass would be liable to break. "It is

understood that sheet mica has come to be of importance as a war mineral, through its use abroad as windows in masks worn for defense against asphyxiating gases."[1] But for these purposes white mica, muscovite is better adapted than Quebec mica, which is amber in colour. The mica mined in the Province, is essentially phlogopite, darker in colour than the muscovite, but much more suitable than the latter for electrical uses. Phlogopite is more elastic, softer and a better insulator than muscovite.

KAOLIN

The production of kaolin, or china clay, from the deposits of Amherst township amounted to 833 tons, valued at $11,744. This is a slight decrease as compared with the previous year. This china clay which is very white, finds a ready sale in the paper industry, being used as a filler for certain grades of paper.

The kaolin deposits of Amherst township are the only workable ones known in Canada. They have been referred to in the Reports of Mining Operations in the Province of Quebec for the past few years, notably in the report for 1914, in which a short description of them is given.

These deposits are situated near the village of St. Rémi d'Amherst, and they are operated by the Canadian China Clay Company, whose main pit and washing-works are situated on lot 5 range VI south, Amherst township. It may be said, however, that the presence of kaolin has been observed on most of the lots from 2 to 10 of this range. As the surface covering is deep, from four to forty feet or more, prospecting and development are arduous.

The figures of production are not an index of the activities of the Canadian China Clay Company, as the main work done during the year consisted in surface work, uncovering as large an area as possible of the kaolin deposit by removal of the soil covering, which in places is quite thick.

A steam shovel was working on this stripping work during the greater part of the summer of 1917. A long continuous trench was made, from the deep cross-trench to the west of the pit, for a distance of 1200 feet eastward. Test pits and trenches prove the presence of clay and silica rock from lot 2 to lot 7 of same range VI

[1]Minerals resources of the U.S. 1916. Page 304.

south, a distance of 4000 feet. In width, test-pits prove the presence of clay and silica rock from the road to a distance of 1000 feet on lot 5.

Much of the kaolin uncovered by the stripping operations, proved to be discoloured and stained by iron oxide, and mixed with silica. The quantity is almost unlimited, but most of it is unsuitable for the production of white china clay or paper filler. Therefore the work of last summer has shown that the deposit is much more extensive than had been anticipated, but most of it is too stained to be used for purposes where white kaolin is required. Briefly stated, instead of a limited deposit of pure, high-priced mineral, as was anticipated, the steam shovel work has uncovered a very large deposit of lower grade substances, very well suited to the manufacture of refractory materials, such as fire brick, silica brick, furnace linings, as well as glass sand and steel foundry sand.

The intention of the operators is to actively develop the refractories end of the enterprise and to manufacture fire-brick, silica brick and magnesite brick on a large scale. Series of experiments have been carried on, and very satisfactory results have been obtained.

Experiments have also been made in tu ning the silica rock and quartz contents of the kaolin into glass-sand, and steel foundry sand. There is quite a demand for these and the experiments having been successful, at the end of the year a plant was being constructed for the production of these two materials.

ANTIMONY

Occurrence of Stibnite at New Richmond, County Bonaventure

Notes by Mr. A. Mailhiot.[1]

This occurrence is on the N.E. half of lot 9 range VI, New Richmond township, county Bonaventure.

The work done on this claim, which comprises an area of 100 acres, includes a vertical shaft 40 feet deep, 10 ft. by 10 ft. opening, sunk on the vein; a second pit 20 ft. deep, 8 ft. by 8 ft., also on the vein, and a stripping or trench, 110 ft. long, connecting the two

[1]Translated from the French.

shafts. Small prospect pits have also been made in the immediate vicinity of the main workings, which were full of water at the time they were visited.

The ore consists of stibnite, disseminated in a quartz gangue. The vein has a maximum width of six inches. Its strike is N. 46°E. and its attitude is vertical. The north wall is a conglomerate of clastic materials of various sizes; the pebbles, which are rounded are of quartz, one inch and less in diameter; the cementing substance is fine sand and other clastic materials. The south wall is constituted by compact white quartzite. The stibnite vein is on the contact between these two formations.

The work on the surface consists of vein stripping over a distance of 110 feet; in depth, as far as could be judged down to the level of the water, the vein seems to narrow considerably and perhaps pinch out. This is the only vein which was visible and it does not appear of sufficient size to be of economic importance.

GRAPHITE

The production of graphite in the province of Quebec, reached record figures, both in quantity and in value. The figures are 1,078,000 lb., valued at $99,024, an average of 9.2 cents a pound. This is an increase of 120,900 lb., or 12.6% in quantity, and of $23,248 or 30.7% in value, as compared with the previous year 1916, when the production was 957,100 lb. valued at $75,776, an average of 7.9 cents a lb. However, the fluctuations in the production of Quebec graphite and variations in prices are very great, for the production for 1915 had been 135,200 lb., valued at $2,461, an average of 1.82 cents a lb.

Throughout the year the market prices of graphite were most favourable, as much as 18 cents a lb. being paid for domestic flake graphite of 90% carbon, whereas Ceylon graphite No. 1 lump was quoted as high as 30 cents a lb., ex-ship, in New York. These prices are, of course, due to the scarcity of ocean freight space, coupled with the demand of the material for war manufactures. These prices are three to five times those which ruled in 1914.

On the other hand the prices for fine dust graphite for foundry facing, for the manufacture of stove polish, and entering into the composition of graphite paints, did not materially increase. The

demand was mainly for the high grades, for the manufacture of crucibles.

The production of graphite in the province of Quebec was restricted to the vicinity of Buckingham, and the producers were the same as last year.

Plumbago Syndicate, Head-Office, 1104 Excelsior Life Bldg., Toronto, composed of a group of Toronto men, operated their mines and the mill for seven months, and shut down in August. This cessation of work was due to a combination of circumstances, among which were scarcity of labour, and inefficiency of it; shortage of coal; and unsatisfactory results obtained by the method of concentration employed which was a dry process throughout.

The Plumbago Syndicate took over the properties of the Dominion Graphite Company in the latter part of the year 1914, and for over a year and a half Mr. H. P. H. Brumell was in charge of operations. When he left in 1916 for Alabama, Mr. R. E. Leighton, of Montreal, was appointed consulting engineer and carried on extensive experiments in dry concentration of the ores, and in August, 1917, when the property was visited by an official of the Bureau of Mines, the mill was treating 50 tons of feed ore, graphite disseminated in sillimanite gneiss and adjoining crystalline limestone, in 24 hours, from which it was claimed that four tons of shipping products was recovered. The graphite produced consisted of No. 1 flake, assaying 90% and over of carbon, No. 2 graphite, assaying 60%, used for lubricants, and No. 3, fine graphite for foundry use and manufacture of paints. The ore fed into the mill was reported to contain an average of 14% graphite.

The mill used is the one which was constructed by the Dominion Graphite Company, and the ore as it comes from the mine goes over a grizzly. The lump ore goes to two drying kiln, of masonry work, and the fines go to a rotary dryer. The dry ore is then crushed, put through trommels and over sizing screens, through roll crushers, over dry separating tables, and the graphite is finished between stones and bagged. The process being dry throughout, the dust which permeates the whole mill is a great inconvenience to the workmen and a possible source of danger. The mill was finally shut down at the end of August, although it is claimed that the products obtained were very satisfactory. The company is now investigating the oil flotation system of concentration as a possibility, and if the results prove satisfactory, will discard the dry system.

While in operation, during the first part of the year, there were 60 men employed, of which 11 were in the mill

The New Quebec Graphite Company, an English Company, with head office in Craven House, Kingsway, London, W.C., England, and Canadian office at Buckingham, worked during all the year. The source of ore is a series of pits situated on lots 1 to 4 range IV of Buckingham township, and the mill used is the one which was constructed in 1913, by the Quebec Graphite Company, the predecessors of the present company. The process of concentration is a wet method which seems to give satisfactory results. It is based on very careful sizing. The ore is crushed in jaw crushers, then passes through roll crushers, from which it is pulverized in a cylindrical ball-mill. The product is carefully sized in trommels which are in double series, and give three sizes which are sent to hydraulic classifiers (sptizkasten). This is followed by treatment on concentration tables (Krupp-Ferraris), of which there are sixteen. The concentrate containing 60% carbon, is then dewatered in a large cylindrical vacuum vessel, the bottom of which is a fine mesh metallic cloth, through which the water is drawn by suction. The dewatered concentrate is then shovelled on trays placed in tiers on trucks, which are wheeled into a long drying room, where the rest of the water is evaporated. The concentrate then passes through a "Sech" pulverizer, which consists of a series of highly polished steel rolls which crush the impurities. These are eliminated by passing over a table with bolting cloth, and the product is graphite of 80 or more or carbon.

The power is supplied by a 160 h.p. Diesel engine, burning crude oil.

The Canadian Graphite Company, who control deposits on lot 1, range III, township of Wentworth, report having done some development work, but have not yet constructed a mill.

Graphite Products, Limited, a company formed to work some graphite occurrences on lots 11 to 14, range VI, township of Amherst, report having done assessment work only, as required by the Mining Law.

GRAPHITE IN ALABAMA

During the year 1917, the graphite industry in Alabama developed rapidly and although no definite figures are available at the present time, the forecast is that it was double that of 1916, when 5,226,940 lb. of crystalline graphite, valued at $492,407 was produced.

A very interesting article on the graphite district of Alabama, by Mr. Irving Herr, appeared in the *Engineering Mining Journal* of April 21st, 1917, and the following notes on the milling practice are extracted from it.

"The ore occurs in large veins of granite schist, the flake graphite partly or entirely replacing the mica. It is unfortunate that the mica is not entirely replaced by graphite, because it follows the latter throughout the milling process. Methods devised for extracting graphite work admirably on mica, both being flake and differing but little in weight. However most of the veins in the vicinity of Ashland are fairly free from mica; and when streaks or bunches do occur in the veins, careful attention on the part of the miner can prevent any quantity of the undesirable material from reaching the mill.

Mining consists simply of quarrying down the ore in large open cuts.

The ore is usually soft on account of the depth of surface decomposition. After reaching the mill, it is put through a crusher of the Blake type and reduced to 2-in. to 3-in. size. From the crusher it may pass on to either a dry pan or muller pan, or to rolls. The dry pans in use are of the type used for grinding clay and are not well adapted to the work required of them. They are constant sources of trouble and require considerable repairs and renewals. The coarse rolls are much to be prefered.

After the ore has been reduced to about half-inch size either by the muller pan or by rolls, it is put through a dryer. This is of a rotary type and is a simple cylinder 4 ft. in diameter by 40 ft. in length, set at a slight angle, $\frac{1}{2}$ inch per ft.

The next stage in the milling process is a further crushing through rolls set close together. Here the final crushed product is obtained. Usually all but about 15% will pass a 20-mesh sieve, and

50% or more will pass a 40-mesh sieve. This final crushing of the thoroughly dried ore is the cause of the dust that makes a graphite mill the dirtiest kind of a plant in existence. Bucket elevators are freely used throughout the mill and even when closely housed in, help to keep the air full of dust.

The ore now enters the first concentrating stage, on washing machines making use of the principle of surface tension. The ore is fed through small spouts from a bin over the washers in such a manner as to form a thin sheet, and falling on an inclined feeding board over which runs a thin stream of water, it is delivered across a sheet of water varying from 6 ins. to 9 ins. in width and 6 ft. long. the length of an individual washer. The gangue sinks and passes out through four small holes distributed along the bottom of the washer, while the graphite rides across on the surface of the water and discharges over a lip extending along the front edge. A trough running along the front of a line of washers carries the flake and water to a shaking screen or dewaterer. This is a rapidly shaking frame operated by a cam and rocker arm and covered on the bottom with fine brass wire cloth, 90- to 100-mesh.

The water and some of the finer flakes escape to the nearest creek, while the main portion of the graphite is discharged over the end of the screen to a floor, where it is piled up as crude concentrates ready to be dried again. This product carries about 50% carbon, the washers unfortunately carrying some sand with the graphite.

"If the feed to a set of washers assays 3% of carbon, the tail sample will assay 1% or more, so the efficiency of the process is not very high. But in defence of the washer it should be said that part of the graphite in the tailing is due to incomplete crushing. The coarser particles of ore still have flake attached.

"In some of the mills this second drying is done by spreading the concentrates in a layer a few inches thick over a large floor built of iron sheets. Steam pipes under the floor supply the heat for drying purposes. Where steam is the motive power in the mill, this forms an economical and satisfactory method, as exhaust steam from the engines is used. Where the drying floor is used, the concentrates from one day's run are spread over it and allowed to remain from 12 to 24 hours. Where the rotary dryer is in use, the feed is continuous and the operation similar to that of the ore drier previously described, except that the flames do not pass through

the shell of the dryer, but along the outside, and the shell is bricked in throughout its entire length.

"The first operation in the finishing mill is an incomplete separation of the flakes of graphite from the sand and grit carried across with the graphite on the washing machines. Some of this gangue matter is pulled across by the flake itself, or a particle of sand may ride across on top of a large flake of graphite. A number of flakes often join hands around a grain of sand and sweep it across into the concentrates without giving it a chance to sink.

"The concentrates being perfectly dry, the first separation is done in an air machine not of standard pattern. It is built on the ground and of a design according to the whim of the particular operator who is installing it. In the main it consists of a hopper discharging along the length of a roll force feed, on the front side of which is an iron plate held against the front of the revolving feed roller to regulate the amount of the feed. The thin layer of concentrates flowing down from the roll feed crosses an air current produced by a small electric fan, and the flake is swung or sucked into the current, while the coarser sand falls through the air stream into a tailings box or middlings box, or both.

"These machines are of crude design and do not do clean work, but are useful, as they take a considerable amount of the burden away from the buhr mills.

"After passing the air machine, the flake is collected in a bin and elevated to a large round or hexagonal sizing reel, which divides the concentrates into three products. The first is dust bolted out through a No. 12 cloth on the upper third of the reel. The second product is the feed for No. 2 buhr mill and passes through a No. 6 cloth on the middle third of the reel. The third product is the feed for the No. 1 buhr mill and is the undersize through a very coarse grit gauze on the lower third of the reel.

"The flake is now sized and in bins ready for the buhr mill. This is simply the old-fashioned flour mill, consisting of two French buhr stones, an upper and a nether, dressed in a little different style and with a graphite dress instead of a white dress. The type is being done away with in modern flour mills, and it is hoped and expected that it will also be scrapped in the graphite mills. At the present it is a costly necessity, costly because it grinds flake into dust, and indispensable because no other method to grind out the

last remnants of the grit has, so far, been discovered, but it will eventually be dispensed with.

"The bolting reels (flour dressers) are set in tandem fashion, one above the other, and there is at least one set for each buhr mill.

"The discharge from No. 1 buhr mill is elevated to the head end of the top reel and passes into it. The speed of the reels is about 30 r.p.m. This reel is covered with No. 12 silk bolting cloth. The undersize is dust and is spouted down to the bagging room. The oversize, a mixture of No. 1 flake, No. 2 flake and middling tails over and is covered with No. 6 cloth. This cloth, containing 74 meshes to the inch, usually makes the separation between No. 1 and No. 2 flake. The undersize through this cloth is a middling and is usually conveyed back to the bin which feeds the No. 2 buhr mill.

"The oversize is No. 1 flake, ready for the market, and is spouted directly to the bagging room. In one mill where an especially high grade product is desired, it is re-dusted in a separate reel together with the finished No. 2 flake, and then again sized and the two products, No. 1 and No. 2, are then spouted to the bagging room."

MINERAL PAINTS

Iron Oxide, and Ochre

The shipments of ochre and natural iron oxide, both raw and calcined, amounted to 9,252 tons, valued at $69,536. This is a slight decrease in tonnage but an increase in value as compared with the previous year.

The returns received showed that shipments of iron oxides or ochre, were made by the following operators:

Canada Paint Company, Limited, Red Mill, Que.—Shipments of calcined natural oxides, used exclusively for paint manufacture. Red Mill is near Three Rivers, P.Q.

Champlain Oxide Company, Champlain, P.Q.—Calcined ochre for paint.

Thomas H. Argall, Pointe du Lac, Que.—Raw oxide of iron, used by gas works for purifying coal gas.

P. Jobidon, Quebec, shipped ochre from a deposit in Iberville township, to paper manufacturers, for use as filler, according to report received.

Besides these, a beginning of exploitation was made by the Paint Products Company of Canada, 46 Notre Dame Street W., Montreal, on a deposit of natural iron oxide, reported of very high grade, situated near l'Ascension, in Labelle county. It is the intention to put up a plant for operating the deposit and for calcining the product.

SILICA, ROCK AND SAND

There has lately been a very active demand for quartz rock and sands, of high grade, for various purposes. Enquiries at the Provincial Mines Branch, from industrialists during the year 1917 covered the following purposes: Quartz rock for the manufacture of ferro-silicon; pure sand for the manufacture of silicate of sodium; sand for glass making; rock or sand for the manufacture of carborundum.

We indicate hereunder the possible sources of material for these purposes in the province of Quebec. It may be mentioned that Mr. L. H. Cole, of the Federal Mines Branch, has for the last three years been making investigations and tests on this subject of sands and other sources of silica, and has gathered a great deal of data on the matter.

The Potsdam formation, which constitutes part of the Cambrian, appears to be the most plentiful source of high grade quartz in the Province. It consists mainly of sandstones of various degrees of purity, often compact and altered to quartzite. This formation is pretty widely distributed, and it occupies large areas in the counties of Beauharnois, Soulanges and Deux-Montagnes. Moreover, in the lower St. Lawrence region, in the counties of L'Islet, Kamouraska, Témiscouata, along the south shore, large patches of Cambrian quartzites have been exposed, mostly by denudation and erosion of the overlying strata. In the lower St. Lawrence region these Cambrian quartzites and sandstones, which rest on the Pre-Cambrian basement, have received the local name of Kamouraska formation. Many outcrops of these quartzites are indicated on the map of Mr. J. A. Dresser, accompanying his report entitled "Reconnaissance along N.T.R. Southern Quebec," issued by the Geological Survey, Ottawa.

Another source of pure silica sand is found in connection with the peculiar occurrence of kaolin in Amherst township. The kaolin is in deposits in a ridge composed of quartzites, referred to the Grenville formation by Dr. M. E. Wilson of the Geological Survey. Part of this quartzite is massive and part has been shattered to a friable condition. It is white and pure, except for an admixture of kaolin, of varied proportion. This friable quartzite, after washing to eliminate the kaolin, which can be recovered, constitutes a silica sand, free from iron, suitable for glass making.

In Vaudreuil county, at Cascade Point, at the eastern end of the Soulanges Canal, a quarry has been in operation for several years in Potsdam sandstone, part of the stone being crushed and used for glass making. The contents in iron sometimes reaches 2 or even 3 per cent, but part of it is removed by washing, leaving a silica sand of fair quality. This quarry is located on lot 1 of the parish of St. Michel de Vaudreuil. It is operated by the Cascades Silica Products Co., 103 St. François Xavier St., Montreal.

Another quarry, in a similar occurrence of sandstone is located at Mélocheville, in Beauharnois county. The rock is also crushed and washed. The Dominion Glass Company, of Montreal, have used comparatively large quantities of this material for the manufacture of common glass.

In 1917, the Stinson-Reeb Builders' Supply Co., of Montreal, opened a quarry of silica rock, on an occurrence of Potsdam sandstone on lots 126–130 of the parish of St. Canute, county of Two Mountains, near the town of St. Jérome. Several analyses of stone from this occurrence of Potsdam quartzite have given over 99% of silica, while the iron oxide varies from 0.07 to 0.50%.

As to the occurrences of Cambrian sandstone on the south shore of the St. Lawrence, below Quebec city, Mr. J. A. Dresser in his report on that region, says: "The quartzite is best exposed in the vicinity of the St. Lawrence river, especially near Kamouraska bay. It is often nearly white in colour, and exceptionally free from iron rust or other stains. It is occasionally used for building stone, and an attempt to employ it for glass manufacture seems to have failed only from adverse market conditions at the time."

As confirmatory to these remarks it may be mentioned that the islands "Les Pélerins," off Pointe St. André, are in great part composed of this quartzite. A representative specimen collected

by an officer of the Federal Mines Branch, was analysed in the laboratory of the Provincial Government and gave silica:- 98.86; iron peroxide 0.26, phosphorus 0.0003.

Mention has been made of the Grenville quartzite of Amherst township, which constitutes the walls and also part of the kaolin deposits of St. Remi. This quartzite is free from iron, and practically the only impurity it contains is kaolin, hydrous silicate of aluminium. This is a mechanical admixture; a process of washing it off has been elaborated and a pure sand is now being produced.

It may also be pertinent to mention that large exposures of a white Grenville quartzite occur in the township of Montauban, in the county of Portneuf, which have been described by Dr. Bancroft, in his report on geology of the zinc and lead deposits of that district.[1] These deposits have not been examined from the standpoint of their industrial utilization, but they would seem to be worthy of an investigation.

PEAT AND COAL

The unusual industrial conditions which have prevailed the world over since the war have given rise to situations which could not have easily been foreseen.

For practically all its industrial fuel, *i.e.*, soft coal, and for most of its domestic heating fuel, anthracite, the provinces of Quebec and Ontario are dependent upon outside sources, Nova Scotia and Pennsylvania in the main. The coal reserves in these coal fields are very large, but the lack of labour to mine the coal and the shortage of cars and vessels for land and sea transportation, have been the cause of an acute fuel crisis. As an example, it may be cited that Nova Scotia in normal years exports annually two million tons of coal to the St. Lawrence markets, of which Montreal and Quebec are the two principal centres. In 1917, these exports fell to less than 75,000 tons.

In the United States the intense industrial production has greatly increased the consumption of coal, and although the output of the mines show an increase in production in 1917 of fifty million tons over 1916, it has been estimated that the shortage for the year was seventy-five million tons.

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[1]See report on Mining Operations in the Province of Quebec during the year 1915.

Under these circumstances, it is natural that attempts, more or less well-advised, should be made to remedy the situation by endeavouring to develop possible sources of fuel within our province.

No economic coal deposits have yet been discovered in our province, and there is very little possibility of there being any. The only carboniferous rocks know in the Province of Quebec constitute a narrow fringe at the extreme end of Gaspé peninsula and these measures belong to the lower part of the Carboniferous, which is not coal bearing. It is true that at various times reports of discoveries of workable coal seams in Gaspé peninsula have circulated, but in every case, on investigation, these "workable" seams have turned out to be small coal beds of lower carboniferous age, of a very few inches in thickness. Such occurrences are known at Gaspé Bay, where a seam of carbonaceous shale and coal, some two to three inches is known. Also in the sea, off Douglastown, at a distance of a hundred feet from the shore, at low tide, a small bed of similar character outcrops.

The Bureau of Mines has had numerous enquiries as to the economic possibilities of the "coal" occurrences in Levis and on the Island of Orleans, the existence of which has been known for seventy-five years; and also to what extent the development of a peat fuel industry in our province could take the place of the importation of coal from outside sources.

As to the possibilities of the Lévis and Island of Orléans "coal" they were thoroughly discussed by Sir William Logan in the report on the geology of Canada, published in 1863, and as practically nothing new has come to light since the publication of this work, the remarks apply now with the same aptness, with the added confirmation of fifty-five years further geological investigations:

"In the Quebec group in Canada, this substance (a black combustible coal-like matter, which occurs in many places in the Quebec group, and has in different localities been mistaken for coal) has been observed at Quebec, Orleans Island, Pointe Lévis, Sillery, St. Nicholas, Lotbinière, Drummondville, Acton, the vicinity of the Chatte River, in Gaspé, and many other places. It fills veins and fissures in the limestones, shales and sandstones and even in the trap rocks which traverse them. Sometimes it is found in buttons or drops, as described by Vanuxem, forming boytroidal masses. At other times it lines fissures, and it may be seen as at Drummond-

ville and at Sillery, spread over a surface which had previously been encrusted with small crystals of calcite. The shrinking of the layers has here given rise to cracks, such as is sometimes seen on the surface of varnish. In other cases it fills fissures several inches in diameter; so it has been mistaken for coal, and attempts have been made to work it at Quebec and elsewhere. The mineral is never, however, in true beds like coal, but is always confined to veins and fissures which cut the strata, showing its deposition to have been posterior to the formation of the rocks. Near to the camp, on the eastern point of the Island of Orleans, there is a considerable vein of it in the shales, from which several hundredweights might easily be obtained. At St. Flavien, in Lotbinière, there occurs, in the copper-bearing shales, a vein of it an inch or two in width. At Acton it fills regular cracks and fissures, and sometimes forms masses of several inches in diameter. This matter is of a shining black colour, very brittle, breaking into irregular fragments with a conchoidal fracture. It is easily pulverized, giving a very black powder, and flies to pieces when heated. It varies considerably in its chemical characters. The mineral from Acton is much harder than that from the other localities mentioned. When heated to redness in a close vessel it gives off a portion of water, but no inflammable gas or vapour, and loses 6.9 per cent of its weight, leaving a carbon which is difficult of combustion, and gives, when incinerated, 2.2 parts of ash. Like the specimens described by Vanuxem, it approaches to anthracite in its characters. That from the other localities examined, gives off when heated, a greater or less proportion of combustible vapour, which condenses in part into a tarry liquid. Carefully selected specimens yield after incineration only a few thousandths of ash, apparently due to accidental impurities. In a specimen from Mountain Hill, Quebec, the volatile matter equalled 19.5 per cent; that from the island of Orleans, 21.0; that from St. Flavien, 15.8; and from another locality six miles from this 24.5 per cent. The latter when exposed to heat swells up and leaves a porous coke, the fragments adhering like a caking coal. The same thing is observed, to a less extent, with the specimen from the Island of Orleans. These carbonaceous matters are insoluble in benzole, with the exception of that last mentioned, which appears to contain a small amount of soluble bitumen."

In the report of the Department of Crown Lands for 1883, Mr. Obalski, the Provincial Mining Engineer, mentions that he examined the occurrences on the Island of Orleans, on the North

shore of the Island, two miles from "Bout de l'Ile." He describes this as a group of veins, having a direction of east and west, on the side of the hill. Half way up the hill these veins of coal-like matter had been uncovered for a length of 7 to 8 feet, and at the foot of the hill, a tunnel had been driven for 49 feet, without giving any further information.

In the same report is mentioned that in building fort No. 3, at Levis, in the same rocks, similar veins have been found, and a certain quantity has been dug out which has been used in a forge.

In the report for 1884, Mr. Obalski gives the following remarks on the occurrence at St. Apollinaire:

"I have examined what is called the coal mine, at St. Apollinaire. A long time ago, similar indications had been noticed, and on these work was undertaken. Several prospecting pits were dug and uncovered schists cut by veins of 3 to 4 inches of coal-like matter which can be used for the forge. A shaft of 15 to 20 feet was put down from which a few barrelfuls of coal were sorted." The undertaking was a failure and the workings were abandoned and full of water at the time of Mr. Obalski's visit.

It may be here mentioned that work was resumed at this place at various times in the hope of striking a bed of coal, and a depth of 75 feet is said to have been reached in the shaft without the slightest improvement in the conditions.

Peat

The question of the utilization of the peat resources of the province has been strongly advocated by the public press, and the general tone of this campaign has been that the production of peat fuel would make the province of Quebec independent of outside sources of fuel.

While a peat fuel industry could do much to relieve such situations as that which prevailed last fall and winter, it would not in any way be the universal panacea which would render us self supporting in the matter of fuel.

Raw peat contains 90 per cent of water, 8 to 9 per cent carbon and other combustible matter. The water is in the peat, not in a form easily drained off, but in the form of hydro-cellulose, a gelatinous matter, which, when submitted to pressure, even in a filter press, either clogs the plates or oozes through the meshes of the cloth.

As to artificial drying, by the application of heat in the form of hot air or steam, the high proportion of water in the raw peat precludes it. Operating on the material of an average peat bog, and admitting a complete theoretical utilization of the heating power of the combustible matter contained in the peat, there would not be quite enough calories to evaporate its own water.

After years of experimenting in Russia, in Germany, in Scandinavia and in Canada, it has been well established that the only workable way of eliminating the water from the peat, is by the old simple way of "air drying," letting the sun and the air do the evaporating.

Air-dried peat manufacture is not only feasible, but could be quite successful in the Province of Quebec, provided that the matter be approached with common sense, and without sanguine hopes of quick fortunes, or of its being a complete remedial measure to our lack of coal deposits. It would, however, bring about much relief in two ways, as follows:

For domestic purposes: as a substitute for wood, in which case it could only be used within a short radius of the bog (perhaps 25 miles), as it would not stand long hauls nor storage.

For industrial uses: by converting the peat into electric power at the bog, either by the use of gas producers, or by means of steam boilers with special grates.

The Fuel Testing Branch of the Department of Mines, Ottawa, has been conducting series of experiments for several years on the utilization of peat, and has investigated and surveyed a number of peat bogs in the Province of Quebec, the following notes being a brief summary of the results of the surveys. For more specific information the reader is referred to the valuable reports published by Fuel Testing Division.

Large Tea Field Peat Bog

This peat bog is situated about two miles north west of Huntingdon Station, in the township of Godmanchester, county of Huntingdon and covers more or less: lots 20-34, range III; lots 20-28, range IV; lot 20, range V; lots 9-20, range II; 10-20, range III; 15-20, range IV.

The total area covered by the bog is approximately 5,268 acres, of this area some 1,960 acres have a depth of less than 5 feet.

Approximately 2,131 acres have a depth of from 5 to 10 feet, and about 1,777 acres have a depth of more than 10 feet.

That portion of the bog which lies east of the road running through the middle of lots 20 is specially suited for the manufacture of machine peat, as it is well humified and of considerable depth.

Small Tea Field Peat Bog

This bog lies about 4½ miles north west of Huntingdon station, or 1½ miles south east of Port Lewis wharf in the township of Godmanchester, county of Huntingdon, Province of Quebec, and runs parallel to the large Tea Field, covering more or less of lots 10 to 35, range I and lots 8 to 32, range II, covering 4,190 acres.

Of this area 1,800 acres have a depth less than 5 feet; 1,530 acres a depth of 5 to 10 feet and 860 acres a depth of more than 10 feet.

The middle part of that portion of the bog lying west of the road running through the middle of lot 20 is very well suited for the manufacture of machine peat.

Lanoraie Peat Bog

This bog is situated at Lanoraie Station on the Canadian Pacific Railway and occupies a part of the county of Berthier and a part of the county of Joliette. The total area covered by this bog is 7,500 acres, of which 3,966 acres have a depth of less than 5 feet; 2,830 acres measure from 5 to 10 feet; 500 acres 10 to 15 feet; 195 acres 15 to 20 feet; 5 acres 20 to 25 feet; 4 acres more than 25 feet.

The middle part of the bog, lying in the southern part of the county of Berthier has a comparatively good depth, is fairly well humified and is suitable for the manufacture of machine peat.

St. Hyacinthe Peat Bog

This bog is situated about two miles south east from the St. Hyacinthe C.P.R. station, in the parish of St. Hyacinthe, counties of St. Hyacinthe and Bagot.

The total area covered by this bog is approximately 3,890 acres, of which 1,394 acres have a depth of less than 5 feet; 1390

acres 5 to 10 feet; 1,074 acres from 10 to 15 feet and 32 acres more than 15 feet.

The peat in St. Hyacinthe county is comparatively well humified; but on account of its inconsiderable depth, and of its having been burnt over several times, it is not suitable for machine peat. The middle part of the bog located in the county of Bagot is very well humified and comparatively deep. It will produce a very good and heavy fuel.

Riviere du Loup Peat Bog

This bog is situated about one mile south of Rivière du Loup station, in the parishes of Terrebois, Rivière du Loup and Leparc and township of Whitworth, in the county of Temiscouata. It covers more or less of the eastern part of the parish of Terrebois; part of the parish of Rivière du Loup; southern part of the parish of Leparc; lot 2 and 3; 22 to 24; 29 to 31, of the township of Whitworth, all in the county of Temiscouata.

The total area covered by this bog is approximately 7,220 acres. It is high and swells up to enormous sponges in different parts. The bog consists of six hills, surrounded by a narrow creek which winds around and supplies the growth of Sphagnum with water.

With the exception of 500 acres lying east of Temiscouata road, it is well humified, is of considerable depth and will produce very good fuel.

Cacouna Peat Bog.

This bog is situated near Cacouna Station, in the parish of Leparc, County of Temiscouata. It covers more or less of the parish of Leparc.

The total area is approximately 845 acres, of which 262 acres have a depth of less than 5 feet; 215 acres 5 to 10 feet; 264 acres 10 to 15 feet; and 104 acres more than 15 feet.

This bog is not sufficiently humified to be utilized for fuel purposes, and it contains too much humus to produce a first-class litter.

Leparc Peat Bog.

This lies about 5 miles east of Rivière du Loup Station, and 500 feet west of Cacouna Station in the parish of Leparc, county of Temiscouata.

The bog comprises approximately 614 acres of which 123 acres have a depth of less than 5 feet; 148 acres 5 to 10 feet; 239 acres 10 to 15 feet and 14 acres more than 15 feet.

The peat is well humified and will produce a very good fuel.

Some years ago an attempt was made on this bog by the Quebec Peat Fuel Company, to manufacture peat fuel in the form of briquettes. The process consisted in macerating the peat and drying the raw product in a small electric drying furnace. When a certain dryness was reached, the peat was mixed with very inferior crude oil, and then pressed into small cylindrical moulds, and ejected as briquettes. In 1901 the buildings were burned down and operations discontinued.

St. Denis Peat Bog

This bog is situated about one mile south of St. Denis wharf, 7 miles north of Rivière Ouelle station, in the parish of Rivière Ouelle, county of Temiscouata, covering more or less of the parish of Rivière Ouelle, county of Kamouraska.

The total area covered by the bog is 315 acres, of which 34 acres have a depth of less than 5 feet; 63 acres 5 to 10 feet; 77 acres 10 to 15 feet; 81 acres 15 to 20 feet and 60 acres more than 20 feet.

The bog is not sufficiently humified to be utilized for fuel purposes. On the average it would produce a fairly good litter.

Riviere Ouelle Peat Bog

This is situated one mile north west of Rivière Ouelle Station, parish of Rivière Ouelle, county of Kamouraska.

The total area of the bog is 4,521 acres. Of this area 2,300 acres are suitable for the manufacture of peat fuel, and 2,221 acres are suitable for peat litter. This bog is a high moor.

The portion of the bog suitable for the manufacture of peat fuel is situated between the margin of the bog and the area having a

depth of 15 to 20 feet. Of this area approximately 802 acres have depth of less than 5 feet; 879 acres 5 to 10 feet and 919 acres from 10 to 15 feet.

L'Assomption Peat Bog

Thig bog lies 2 miles south of l'Epiphanie station, and approximately a mile and a half north-east of Cabane Ronde Station in the seigniory of l'Assomption. It covers a part of the seigniory.

The total area of the bog is approximately 1,565 acres, of which 256 acres have a depth of less than 5 feet; 722 acres 5 to 10 feet; 555 acres of 10 to 15 feet and 25 acres of more than 15 feet.

The largest portion of the bog from the north east towards the south west is exceptionally well suited for manufacturing peat fuel. It is very well humified, possesses high cohesive properties and has considerable depths.

The bog is very advantageously situated with regard to shipping facilities and market, being only 18 miles from Montreal, with the Canadian Pacific Railway parallelling the northern side at a distance of one thousand feet to half a mile, and the Canadian Northern Railway crossing at L'Epiphanie 2 miles east of the bog. On the whole this bog is one of the most favourably situated of those so far investigated; it has all the advantages for the manufacture of peat fuel.

St. Isidore Peat Bog

This bog is situated about 3 miles south of St. Isidore station, and occupies 1,231 acres at the junction of the counties of Laprairie, Chateauguay and Napierville.

The central portion of this bog, in the counties of Laprairie and Napierville is well humified and is of a considerable depth. The surface is heavily wooded with small willows, poplars and alders.

When this area has been cleared of trees and bushes, working lines of considerable length may be secured and a modern plant for manufacturing machine peat by the air-dried process could be favourably operated.

Holton Peat Bog

This is situated 2 miles east of the Holton station and 1 mile west of Barrington in the counties of Chateauguay, Napierville and

Huntingdon. Its area is approximately 6,181 acres, of which 2,704 acres have a depth of less than 5 feet, and 3,477 acres more than 5 feet.

The centre of the bog, north of the Grand Trunk Railway is fairly well humified, but is shallow in depth.

Farnham Peat Bog[1]

This bog is situated about one mile to the east of Ste. Brigide Station and about 3 miles to the west of Farnham. One arm of the bog bends around to within a mile of Farnham, and runs in a southwesterly direction.

The larger part of the bog is in the county of Iberville, but there is also a considerable portion of it in the county of Missisquoi, the bog lying across the county line to the southwest of Farnham. The total area covered by this bog is approximately 5,100 acres.

Canrobert Peat Bog

In the county of Rouville, about 2 miles east of Canrobert station, on the C.P.R. and about the same distance west of Angeline station on Central Vermont Railway.

The total area covered by the bog is approximately 2,000 acres.

Napierville Peat Bog

This bog is situated about four miles to the north of Henrysburg station, on the Grand Trunk Railway, and about the same distance to the southwest of Napierville station on the Delaware and Hudson Railway; the bog is almost entirely in the county of Napierville, Province of Quebec, and runs in an east and west direction.

The total area covered by this bog is approximately 7,200 acres.

Girard Peat Bog

This is situated about 1¾ miles northwest of Girard station, and 8 miles south of the city of St. Jean, in the counties of St. John's and Napierville.

The total area covered by this bog is approximately 3,104 acres.

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[1]This bog and the four bogs following were investigated and surveyed by the Canadian Department of Mines in 1915 and 1916, and the detailed report is now in press.

Pont Rouge Peat Bog

This is situated 1½ miles from Pont Rouge village, in the parish of Neuville, county of Portneuf.

The total area covered by this bog is approximately 125 acres.

BUILDING MATERIALS

The total value of the building materials produced in the Province of Quebec in 1917, amounted to a value of $5,384,898. This is a slight increase as compared with the previous year when the value was $5,278,406.

As a matter of fact the quantities of materials produced show a decided decrease as compared with 1916, and the figures of quantities are lower for brick, cement, limestone, but owing to higher cost of production and consequent higher market prices, the values have increased to more than make up for the decrease in quantities.

It is gratifying to note that the production of building materials has not been more affected than it has by the present economic conditions. The following figures show that if we compare the banner year of 1913 with those of the present year we record a decrease of only 34%.

STRUCTURAL MATERIALS.—ANNUAL VALUES

Year	Value	Year	Value
1912	$7,196,154	1915	$6,242,234
1913	8,186,917	1916	5,278,406
1914	7,799,294	1917	5,147,089

LIST OF THE

PRINCIPAL OPERATORS AND OWNERS OF MINES AND QUARRIES

IN THE PROVINCE OF QUEBEC

ASBESTOS

Anglo-Canadian Export Company,
Room 4, Windsor Hotel, Montreal.

Asbestos Corporation of Canada Limited,
J. McCallum, Secretary, Thetford Mines, Que.

Bell Asbestos Mines,
Hon. Geo. R. Smith, Vice-Pres. and Mgr., Thetford Mines, Que.

Bennett-Martin Asbestos and Chrome Mines, Limited,
Thetford Mines, Que.

Black Lake Asbestos & Chrome Co., Limited,
J. E. Murphy, Mgr., Black Lake, Que.

Eastern Townships Asbestos Co.,
P. Anger, Mgr., Beauceville, Que.

The Federal Asbestos Co., Limited.
J. M. Forbes, Mgr., Robertsonville, Que.

The Frontenac Asbestos Mining Co.,
F. W. Ross, Mgr., 92 St. Peter Street, Quebec City.

Imperial Chrome Co.,
P. Poudrier, Mgr., Black Lake, Que.

Jacob Asbestos Mining Co., of Thetford, Limited,
N. Fisher Mgr., Thetford Mines, Que.

Johnson's Co.,
A. S. Johnson, Mgr., Thetford Mines, Que.

Jos. M. Johnston,
Black Lake, Que.

Manville Asbestos Company,
Danville, Que.

The Martin-Bennett Asbestos Mines, Limited,
H. E. Peters, Secretary, Thetford Mines, Que.

Quebec Asbestos Corporation,
E. E. Spafford, Mgr., East Broughton, Que.

Windsor Asbestos Mining Company Limited,
Coleraine, Que.

CHROME

J. V. Bélanger,
Black Lake, Que.

Bennett-Martin Asbestos and Chrome Mines, Limited,
Fred. Bennett, Manager, Thetford Mines, Que.

Black Lake Asbestos & Chrome Co., Limited,
J. E. Murphy, Manager, Black Lake, Que.

Dominion Mines & Quarries Limited,
Dominion Bank Building, Toronto, Ont.

The Fletcher Pulp & Lumber Co., Limited,
H. Bruce Fletcher, Secretary, Sherbrooke, Que.

L. H. Huard,
Thetford Mines, Que.

Jos. M. Johnston,
Black Lake, Que.

J. D. Kennedy,
Sherbrooke, Que.

The Martin-Bennett Asbestos Mines, Co.,
H. E. Peters, Secretary, Thetford Mines, Que.

S. E. Melkman,
211 McGill St., Montreal.

Mutual Chemical Company of Canada, Limited,
Black Lake, Que.

Quebec Asbestos & Chrome Co.,
Douglas B. Sterrett, Manager, St. Cyr, Richmond, Que.

David Wilson,
Sherbrooke, Que.

COPPER

Campbell & Forbes Syndicate,
319 Coristine Building, Montreal, Que.

Eustis Mining Company,
F. M. Passow, Manager, Eustis, Que.

S. E. Melkman,
605 McGill Bldg., Montreal.

A. O. Norton,
W. Jenkins, Manager, Coaticook, Que.

N. S. Parker,
Eastman, Que.

Auguste Renault,
Ville Marie, Que.

Pierre Tétreault,
416 Power Building, Montreal.

Weedon Mining Co., Limited,
L. D. Adams, Pres., 609 Eastern Townships Bank Bldg., Montreal.

FELDSPAR

S. Carsley & Co.,
151 Notre Dame St. W., Montreal.

Eureka Flint & Spar Co.,
Trenton, N.J.

O'Brien & Fowler,
Bush Winning, Manager, Beech & Preston Sts., Ottawa.

GOLD

Champs d'Or Rigaud-Vaudreuil,
Room 425, Transportation Bldg., Montreal.

Eustis Mining Co.,
F. M. Passow, Manager, Eustis, Que.

Martin Gold Mining Co.,
Amos, Que.

J. F. Stabell & Co.,
1127 Niagara St., Buffalo, U.S.A.

Weedon Mining Co.,
L. D. Adams, Mgr., 609 Eastern Townships Bank Bldg., Montreal.

Zinc Company Limited,
Room 605, Eastern Townships Bank Bldg., Montreal.

GRAPHITE

Bell Graphite Co., Limited,
Box 185, Buckingham, Que.

The Canadian Graphite Co.,
T. W. P. Patterson, Manager, Room 34, Coristine Bldg., Montreal.

Graphite Products, Limited,
189 St. James St., Montreal.

New Quebec Graphite Co., Limited,
R. C. Rowe & C. N. Daly, Managers, Buckingham, Que.

Plumbago Syndicate,
Excelsior Life Bldg., Toronto.

IRON & TITANIC IRON

American Titanic Iron Co.,
c/o Hon. S. N. Parent, Parliament Bldg., Quebec City.

Baie St. Paul Titanic Iron Ore Mining Export Co.,
J. O. Paré, Manager, Baie St. Paul, Charlevoix Co., Que.

Canada Iron Foundries, Limited,
Mark Fisher Building, Montreal.

General Sir John Carson,
18 Royal Insurance Bldg., Montreal.

Manitou Iron Mining Co.,
Jos. E. Globensky, 364 University St., Montreal.

KAOLIN

Canadian China Clay Co., Limited,
Room 521, Transportation Bldg., Montreal.

St. Remi Kaolin Co.,
Campbell Bldg., Elmira St., Montreal.

MAGNESITE

W. P. Boshart,
Calumet, Que.

Canadian China Clay Co., Limited.
Room 521, Transportation Bldg., Montreal.

Dominion Magnesite Co.,
Calumet, Que.

International Magnesite Co.,
708 Eastern Townships Bank Bldg., Montreal.

North American Magnesite Co.,
Room 36, Board of Trade Bldg., Montreal.

N. S. Parker,
Eastman, Que.

Scottish-Canadian Magnesite Co., Reg'd,
211 McGill St., Montreal.

MICA

William Argall,
Laurel, Argenteuil Co., Que.

Beaver Mica Mfg., Co., Limited,
124 Rideau St., Ottawa, Ont.

Blackburn Brothers,
H. L. Forbes, Manager, 212 Creighton Street, Ottawa.

Brown Brothers,
Cantley, Que.

John Burns,
Mica Mine P.O., County Labelle, Que.

Calumet Mica Co.,
3 Clarence St., Ottawa.

Capital Mica Co., Limited,
W. Ahearn, Manager, St. Pierre de Wakefield, Que.

Chabot & Co.,
124 Rideau St., Ottawa.

La Compagnie Minière de Mica Blanc,
1 Beaver Hall Hill, Montreal.

William Cleland,
Bouchette, Wright Co., Que.

Cross & Wilson,
Cascades, Hull, Que.

J. De Rainville,
St. Pierre de Wakefield, Que.

Joshua Ellard,
Wright, Que.

H. T. Flynn,
106 Montcalm Street, Hull, Que.

Gatineau Valley Mica Co.,
Rinaldo McConnell, 1000 Kent Bldg., Toronto, Ont.

J. B. Gauthier,
Box 226, Buckingham, Que.

J. B. Gorman,
Box 166, Buckingham, Que.

Wm. Gowan,
Holland Mills, Que.

Laurentide Mica Co., Limited,
corner Bridge and Queen Streets, Ottawa.

The Loughborough Mining Co.,
N. J. Sproule, Manager, c/o G. W. McNaughton, Sydenham, Ont.

R. J. McGlashan,
Cantley, Que.

A. G. Martin,
236 Besserer St., Ottawa, Ont.

Adelard Morin,
Val des Bois, Labelle Co., Que.

O'Brien & Fowler,
Bush Winning, Manager, Beech and Preston Sts., Ottawa.

W. L. Parker,
Buckingham, Labelle Co., Que.

Progressive Mining Company,
P. H. Chabot, Ottawa, Ont.

Vavasour Mining Association,
22 Metcalfe Street, Ottawa, Ont.

Wallingford Bros.,
Banque Nationale Bldg., Ottawa, Ont.

Wallingford Mica & Mining Co.,
Perkins, Que.

Watts & Noble,
Perkins Mills, Que.

Webster & Co.,
274 Stewart Street, Ottawa, Ont.

MINERAL WATER

Abenakis Mineral Spring Co., Limited,
W. E. Watt, Manager, Abenakis Springs, Que.

Alfred Ferland,
1661 rue Bordeau, Montreal.

Gurd & Co., Limited,
74 Bleury Street, Montreal, Que.

Lyall Trenholm & MacDonall,
Montreal West, Que.

Radnor Water Co.,
Geo. C. Kemp, Manager, Mark Fisher Building, Montreal, Que.

Ratté & Frères,
22 rue Bigaouette, Quebec City.

Cyprien Roy,
St. Germain, Kamouraska, Co., Que.

La Société des Eaux Naturelles du Canada,
Trois Rivières, Que.

St. Léon Mineral Water Co.,
R. W. Nebb, Manager, Toronto St., Toronto, Ont.

M. Timmons & Son,
Côte d'Abraham, Quebec City.

Veillet & Frère,
Ste. Geneviève, Batiscan Co., Que.

MOLYBDENITE

Aldfield Mineral Syndicate,
667 Echo Drive, Ottawa, Ont.

H. A. Bertram,
Room 600, Drummond Bldg., Montreal.

L. N. Benjamin,
55 St. Frs. Xavier St., Montreal.

Ed. Chaput,
Aylmer East, Que.

Chabot & Co.,
124 Rideau St., Ottawa, Ont.

Dominion Molybdenite Co., Limited,
Quyon, Que.

M. L. Foley,
12 Maynard ave., Toronto.

The Height of Land Mining Co.,
S. P. Wilson, Mgr., 316 St. James St , Montreal.

Chas. O. Ross,
667 Echo Drive, Ottawa, Ont.

The St. Maurice Mines Co., Limited,
c/o A. E. Doucet, Quebec City.

Standard Molybdenite Company, Limited,
Ottawa, Ont.

Wood Molybdenite Company,
14 Metcalfe St., Ottawa, Ont.

NATURAL GAS

The Canadian Natural Gas Co.,
P.O. Box 2072, Montreal.

The National Gas Co., of Canada,
c/o Mr. E. B. Devlin, Hull, Que.

OCHRE

Thos. H. Argall,
P.O. Box No. 2, Three Rivers, Que.

Canada Paint Co., Limited,
Jos. Bradley, Manager, Red Mill, Que.

Champlain Oxide Co.,
Lucien Carignan, Manager, Three Rivers, Que.

P. Jobidon,
12 rue Ste. Famille, Quebec City.

Francois Ouellet,
Ste-Gertrude, Nicolet Co., Que.

Paint Products Co. of Canada,
46 Notre Dame St. W., Montreal.

PEAT

Peat Industries Limited,
Imperial Bank Chambers, Montreal.

PHOSPHATE

Blackburn Bros.,
H. L. Forbes, Manager, 134 Wellington St., Ottawa.

F. Burgoyne,
Buckingham, Que.

J. G. Higginson,
Buckingham, Que.

O'Brien & Fowler,
Bush Winning, Manager, Beech and Preston Sts., Ottawa

W. Gowan,
Poltimore, Que.

Papineau Lumber Co., Limited,
H. T. Tétreau, Manager, Papineauville, Co. Labelle, P.Q.

D. Vallier,
Buckingham, Que.

Walingford Mica & Mining Co.,
Banque Nationale Bldg., Ottawa.

Edward Watts,
19 Chestnut Park, Toronto, Ont.

SILICA, ROCK AND SAND

Canadian China Clay Co.,
521, Transportation Bldg., Montreal.

Cascades Silica Products Company,
103 St. Frs. Xavier, Montreal.

Dominion Glass Company,
Royal Trust Bldg., Montreal.

J. McClements,
Buckingham, Que.

Montreal Sand and Gravel Co., Limited,
270 Ottawa St., Montreal.

G. Pudenaud,
Buckingham, Que.

J. Stewart,
Buckingham, Que.

Stinson-Reeb Builder's Supply Co.
Room 203, Read Bldg., St. Alexander St., Montreal.

SILVER

Eustis Mining Co., Limited,
F. M. Passow, Manager, Eustis, Que.

Weedon Mining Company,
L. D. Adams, President, Weedon, Que.

Zinc Company, Limited,
Room 605, Eastern Townships Bldg., Montreal.

TALC

J. N. Martel,
Belmina, Wolfe Co., Que.

Geo. R. Pibus,
Knowlton, Que.

ZINC AND LEAD

Federal Zinc and Lead Co.,
315 Transportation Bldg., Montreal.

The Laurentide Mining Co.,
Notre Dame des Anges, Portneuf Co., Que.

Montauban Mining Sundicate,
N. Thibault, Notre Dame des Anges, Portneuf Co., Que.

The New Richmond Mining Co.,
New Richmond, Que.

North American Mining Co.,
New Carlisle, Que.

Pierre Tetreault,
Room 416, Power Bldg., Montreal.

Zinc Company, Limited,
Notre Dame des Anges, Portneuf County, Que.

BRICK

N. L. Auger,
Ville de St. Tite, Champlain Co., Que.

W. D. Bell,
1286 St. Valier St., Quebec City.

The Citadel Brick & Paving Block Co., Limited,
P. Galarneau, Manager, 42 Dalhousie St., Quebec City.

La Compagnie de Briques de Matane,
St. Jerome de Matane, Que.

Olivier Danville,
St. Casimir, Que.

The Eastern Townships Brick & Mfg., Co.,
Lennoxville, Que.

R. J. A. Grenier,
Rapide de l'Orignal, Que.

David F. Hodgins,
Box 87, Shawville, Que.

Lafontaine & Martel,
St. Tite, Champlain Co., Que.

Stanislas Laliberté,
St. Jean Deschantillons, Que.

Emile Longpré,
St. Félix de Valois, Que.

The Mack Brick Co.,
260 St. James St., Montreal.

Alex. Mills,
Ormstown, Chateauguay Co., Que.

National Brick Co. of Laprairie, Limited,
10 Victoria Square, Montreal.

Paradis & Létourneau,
Stadacona, Quebec City.

J. M. Potvin,
Lachute, County Argenteuil, Que.

Proulx Brothers,
Richmond, Que.

The Sherbrooke Tile & Brick Co.,
Record Block, Sherbrooke, Que.

Arthur St. Amand,
Aston Station, County Nicolet, Que.

The St. Lawrence Brick Co., Limited,
71 St. James Street, Montreal, Que.

Emile Théroux,
Mitchell Station, Que.

Joseph Tondreau,
L'Islet Station, Que.

The Warwick Brick Co.,
Warwick, Que.

CEMENT

Canada Cement Co., Limited,
F. P. Jones, Manager, Herald Building, Montreal.

GRANITE

The B. & L. Granite Co., Limited.
20 St. James St., Montreal.

Auguste Bernier,
Roberval, Que.

James Brodie,
Graniteville, Que.

James Brodie & Son,
128 Bleury Street, Montreal.

Joseph Brunet,
663 Côte des Neiges Road, Montreal.

La Compagnie de Granit de Mégantic, Limitée,
Lac Mégantic, ue.

Augustin Delisle,
Rivière à Pierre, Que.

Alex. Doyer,
Rivière à Pierre, Que.

Dumas & Frère,
Rivière à Pierre, Que.

National Battlefields Commission,
2 Cook St., Quebec City.

S. B. Norton,
Beebe Jct., Stanstead Co., Que.

R. A. Rideker,
Graniteville, Que.

Stanstead Granite Quarries Co., Limited,
Beebe Jct., Stanstead Co., Que.

Fortunat Voyer & Frères,
Rivière à Pierre, Que.

LIME

Arnaud & Beaudry,
Joliette, Que.

Adolphe Barron,
La Carrière, Que.

Arthur Boivin,
Pont Rouge, Portneuf Co., Que.

R. B. Carswell,
Bryson, Que.

Gaspard Desfonds,
St. Cuthbert, Que.

Achille Desilets,
St. Louis de Champlain, Que.

Dominion Lime Co.,
Sherbrooke, Que.

C. A. Gervais, Estate
1460 Cadieux St., Montreal.

Octave Héon,
St. Louis de Champlain, Que.

Magloire Leclerc,
St. Dominique, Que.

Johnny Lefebvre,
St. Louis de Champlain, Que.

Olivier Limoges,
477 Papineau Ave., Montreal.

Laurentian Stone Co., Limited,
Hull, Que.

Missisquoi Marbles Limited,
Philipsburg, Missisquoi Co., Que.

Thos. McCambly,
Kazubazua, Que.

Montreal Lime Co.,
31 Prenoveau St., Montreal.

Placide Sanche,
Côte St. Louis, Ste. Thérèse, Terrebonne Co., Que.

Thos. Sharpe,
Coldwell, Que.

Sovereign Lime Company Limited,
Delorimier Ave. & C. P. R. Tracks, Montreal.

Standard Lime Co., Limited,
St. Paul, Joliette Co., Que.

LIMESTONE

Jos. P. Beaudry,
Joliette, Que.

Dr. P. Bertrand,
Shawinigan Falls, Que.

Canada Carbide Company, Limited,
Power Bldg., Montreal.

Canada Iron Foundries Limited,
Imperial Bank Bldg., Montreal.

Carrière de Quebec, Limité,
Quebec Ry. Bldg., Quebec City.

Chateau Richer Quarry Co.,
Sault a la Puce, Montmorency, Que.

La Cie de Briques de Québec, Limitée,
Beauport, Que.

La Cie des Carrières,
St. Marc des Carrières, Que.

The L. Deguire Quarry Co.,
St. Laurent, near Montreal, Que.

The DeLorimier Quarry Co.,
1952 Iberville St., Montreal.

Frank Deraiche,
Chandler, Gaspé.

Deschambault Quarry Corporation,
52 St. Paul St., Quebec City.

The Deschambault Stone Co., Limited,
St. Marc des Carrières, Que.

Pite Desroches,
Joliette, Que.

R. C. Dickson,
601 Monsabré, Montreal.

Cyrille Durocher,
5379 Notre Dame St., Montreal, Que.

East End Quarry,
2753 Dandurand St., Montreal.

The Federal Stone & Supply Co., Limited,
213 Sussex St., Otttawa.

Martin-Gagnon & Frères,
3363 Lajeunesse St., Montreal.

Institution des Sourds-Muets,
1941 St. Dominique St., Montreal.

Kennedy Construction Co., Limited,
704 Shaughnessy Bldg., Montreal.

The Félix Labelle Quarry Co., Limited,
St. Francois de Sales, Que.

Louis Labelle & Cie,
57 Notre Dame west, Montreal.

Joseph Lapointe,
Cartierville, Que.

Laurentian Stone Co., Limited,
53 rue Albert, Hull.

Laurin & Leitch,
5 Beaver Hall Sq., Montreal.

Olivier Limoges,
477 Papineau St., Montreal.

Narcisse Lord,
St. Jean, Que.

Maisonneuve Quarry Co., Limited,
2855 Boulevard, Rosemont, Montreal.

O. Martineau & Fils, Limited,
371 Marie Anne Ave., Montreal.

Montreal Concrete Works Co., Limited,
413 Power Bldg., Montreal.

The National Quarry,
81 St. Peter St., Quebec.

Jos. D. Naud,
St. Marc des Carrières, Que.

Louis Perron,
Grande Ligne, County St. Jean, Que.

Price Bros. & Co., Limited,
Chambord, Que.

Richelieu Quarry Co.,
J. O. Gagnon, Box 428 St. Jean, Que.

Rogers & Quirk,
1701 Iberville Street, Montreal.

A. Simard,
Chambly, Que.

The St. Laurent Quarry Co., Limited,
Cap St. Martin, Laval Co., Que.

Standard Lime Co., Limited,
St. Marc des Carrières, Que.

Stinson-Reeb Builders Supply Co., Limited,
903 Read Bldg., Montreal.

Pierre Tétreault,
416 Power Bldg., Montreal.

Napoléon Tremblay,
Chenes Avenue, Hull, Que.

Elzéar Verreault,
7 Ramsay St., Quebec.

Victor Quarry Co.,
147 Mountain Hill, Quebec.

Villeray Quarry Co., Limited,
848 Du Rosaire Street, Montreal.

Vinet & Durand,
4631 Notre Dame St. East, Montreal.

MARBLE

Missisquoi Marbles Limited,
Philipsburg, Que.

The Pontiac Marble & Lime Co., Limited,
193 Sparks St., Ottawa.

POTTERY

W. D. Bell,
1286 St. Valier St., Quebec City,

Canadian Trenton Potteries Co., Limited,
St. John's, Que.

The Citadel Brick & Paving Blocks Co., Limited,
42 Dalhousie St., Quebec.

Dominion Sanitary Pottery Co.,
189 St. James St., Montreal.

E. L. Farrar,
Iberville, Que.

David T. Hodgins,
Shawville, Que.

Montreal Fire-Brick Works, Limited,
399 St. Ambroise St., Montreal.

Montreal Terra-Cotta Lumber Co.,
23 Board of Trade Bldg., Montreal.

Poterie Dion Enrg.,
40 Dominion Bldg., Quebec City.

Standard Clay Products Limited,
St. Johns, Que.

St. Lawrence Brick & Paving Block Co., Limited,
Dalhousie St., Quebec City.

SAND

Atlas Sand Company, Limited,
77 Common St., Montreal.

Robert Boa,
Hillhead, Argenteuil Co., Que.

The Bonner Sand & Ballast Co.,
South Durham, Que.

Canadian Sand & Gravel Co.,
Richmond and William Sts., Montreal.

Chevrier & Guertin,
St. Joseph de Sorel, Que.

Compagnie Sable Union Limitée,
105 Dalhousie St., Quebec City.

Dominion Sand & Stone Co., Limited,
506 Canadian Express Building, Montreal.

Keystone Wall Plaster Co.,
Ste. Thérèse de Blainville, Que.

Laurentide Sand & Gravel Co.,
11 Sault au Matelot, Quebec, Que.

J. J. Miller,
833 St. Valier St., Quebec, Que.

Montreal Sand & Gravel Co.,
270 Ottawa Street, Montreal.

Napoléon St. Louis,
Fontarabie, Maskinongé Co., Que.

Villeneuve & Co.,
St. Jerome, Terrebonne Co., Que.

SANDSTONE

Montreal Sand & Gravel Co., Limited,
270 rue Ottawa, Montreal.

H. F. Routhly,
Haileybury, Ont.

The Stinson-Reeb Builders Supply Co.,
Room 203, Read Bldg., Alexander St., Montreal.

The Sydney Kirby Co.,
213 Sussex St., Ottawa.

SLATE

The New Rockland Slate Co.,
Room 408, Merchants Bank Bldg.,
205 St. James St., Montreal.

STATISTICS OF ACCIDENTS*

REPORTED FROM THE MINES AND QUARRIES DURING THE YEAR 1917

(A. O. Dufresne)

The year 1917 has been exceptional as to the small number of fatal accidents which have occurred in the mines and quarries of the Province of Quebec. Only four fatalities were reported during the year, which gives an average of only 0.6 deaths per thousand men employed. The Mines Branch has taken particular pains and made special efforts in keeping its records of accidents as up to date as possible, and all the fatal accidents have certainly been reported, but we draw the attention to the fact that the number of these accidents was unusually low and much below the average. For the last five years the figures have been as follows: 1913, 1.86; 1914, 1.29; 1915, 2.25; 1916, 2.70; 1917, 0.6. If we take only the mines proper into consideration we arrive at the following figures for these respective years: 3.19, 2.95, 3.34, 3.22, and 0.86. Therefore the last figures are only about one-quarter of the others. This is a disparity which cannot be explained. We may say, however, that as a rule, operators are giving more and more thought to the questions of "Safety first" and the security of workmen. In many cases special gangs of men are charged with the scaling of walls and careful cleaning of all loose rock; with the maintenance of track ways; examination of all hoisting and hauling ropes and more especially of cable-derrick ropes.

In common with all other industries, the mines of the province have keenly felt the scarcity of labour, which has been increasing with the intensive mineral production necessitated by war needs. During a great part of the year the mines could not be worked to the capacity of the plants on account of the lack of labour. As in the case of all mines situated in farming regions , farm labour was used as much as possible during the winter. Wages were very high during the whole of the year. In the spring unskilled labour was 25 cents an hour, machine men 27½ cents, and for night shifts the rate was 30 cents an hour. In November the mine operators at Thetford, gave an increase of 25 cents a day of their own initiative.

*Translated from the French.

The wages are at present $3.25 to $3.50 a day. In the Province of Quebec the ten-hour day prevails.

Owing to the necessity of intense production most of the mines worked day and night. In the case of open pits, as in the asbestos mines, they were lighted by means of strong reflector electric lights by Davis Flood light system. The arc-lights in these cases have been replaced by powerful incandescent lights of 1,000 watts, with metallic filament and nitrogen atmosphere. The bulbs are placed in a reflecting device with directing mirrors for the light rays. This system of lighting has the great advantage over the arc light, of giving a perfectly steady light quite exempt from the vibrations and uneveness of arc lights. This steadiness of light may frequently be a cause of avoidance of accidents. A vibrating light may give rise to shadows which would conceal loose rocks and other sources of danger. At the King Mine, eight of these lights are in use.

TABLE I

Persons employed in the Mines, Quarries and Concentrating Mills in the Province of Quebec

Mines, Quarries and Mills	Number of men calculated on 300 days	
	1916	1917
Asbestos (quarries and mills)	2,705	3,134
Copper and Pyrite, Silver, Gold	361	308
Chrome, Titaniferous Ore, Zinc and Lead	373	438
Feldspar, Kaolin, Quartz (quarries, pits and mills)	53	42
Graphite, Mica, Phosphate	211	238
Magnesite	179	252
Mineral Water (springs and works)	11	4
Molybdenite	85	140
Ochre	57	48
Brick, Pottery (clay pits and mills)	518	373
Cement (quarries and mills)	626	645
Granite	294	111
Lime (quarries and kilns)	177	139
Limestone (quarries and dressing works)	775	504
Marble, Slate and Sandstone	112	56
Sand (pit and river)	64	65
	6,601	6,497

During the year 1917, the number of men who worked the equivalent of a whole year, that is to say 300 days work, was 6,497. During the preceding year this number was 6,601. This is therefore a slight decrease of 1.6%. As may be seen from the table, page 9, there have been 7,712 men who found employment in the mines and quarries for various periods during the year, and these numbers being reduced to a uniform basis of 300 days work for each man, for statistical purposes, we arrive at the number of "men-year" given above. In 1916 there had been 8,263 men employed for various periods. This decrease may be ascribed to a great extent, to the closing down of many stone quarries due to the decrease in building operations. Although the total value of the production of building materials is practically the same this year as in 1916, the number of workmen employed shows a decrease of 35%. Or in other words the number of workmen in the quarries has decreased from 2,574 in 1916 to 1893 in 1917.

TABLE II

Workmen in	Number	Salaries	Number of days' work	Number of men on 300 days' basis
Producing Mines.....	4,876	$3,255,397	1,362,373	4,541
Non-Producing Mines..	130	40,974	18,827	63
Totals.....	5,006	$3,296,371	1,381,200	4,604

The labour expended on assessment work for retaining rights on lands leased under the provisions of the Mining Act is not included in this table.

As to the mines proper we record a noticeable increase. In 1916 there had been 4,035 men employed in the mines whereas in 1917 there were 4,604 or an increase of 14%. This is mainly due to the activity in the asbestos mines, most of which worked night shifts, as well as to the intensive operation of the pyrite mines of the Eastern Townships, the lead and zinc mines of Montauban and Gaspé, and of the mines of chromite, molybdenite, magnesite,

graphite, mica, kaolin and others, which were worked actively. These figures are the number of men-year, that is to say the total number of days work, divided by 300. This is the basis of all our comparisons and calculations.

Wages having been higher this year than in 1916, notwithstanding the slightly inferior number of men employed in 1917, the total of the wages paid was higher than for the preceding year. From $4,447,293 in 1916 it rose to $4,868,748 in 1917, an increase of 9%. Of this total $3,296,371 was paid to the men working in the mines proper.

TABLE III

Workmen in	Number of men on 300 days' basis	Accidents		Total	Per 1,000 employed
		Fatal	Non-fatal		
Mines	4,604	4	164	168	36.5
Quarries	1,893	0	3	3	1.6
Totals	6,497	4	167	171	26.3

TABLE IV

Accidents in Mines, Quarries and Mills of the Province of Quebec for 1917.

	Fatal		Non-fatal		Totals	
	No.	%	No.	%	No.	%
MINES:						
Underground	1	0.6	10	5.8	11	6.4
Open pits	1	0.6	102	59.6	103	60.2
Surface	1	0.6	28	16.4	29	17.0
	3	1.8	140	81.8	143	83.6
QUARRIES:						
Pits	0	0.0	2	1.2	2	1.2
Surface	0	0.0	0	0.0	0	0.0
	0	0.0	2	1.2	2	1.2
MILLS:						
Mills	1	0.6	18	10.5	19	11.1
Shops	0	0.0	6	3.5	6	3.5
Power Plants	0	0.0	1	0.6	1	0.6
	1	0.6	25	14.6	26	15.2
Totals	4	2.4	167	97.6	171	100.00

Table III shows the number of workmen employed in mines and quarries and the number of fatal and non-fatal accidents. In the table the word "quarry" includes clay-pits and sand-pits.

During the year the Mines Branch was advised of 171 accidents, as having occurred in mines, quarries and mills in connexion with these. Only four of these accidents resulted fatally. The number of returns of accidents received per 1,000 men employed was less than during the preceding year. From quarries only three non-fatal accidents were reported and apparently no fatal accidents occurred. In 1916 there had been 18 fatalities in mines and quarries, whereas this year we only record 4, which is a proportion of 0.6 per 1,000 men employed. Of these four accidents, two occurred in the mines themselves and the other two in mills. Of the two first ones, a fatality occurred from a premature explosion of dynamite while preparing to blast, and the other victim was killed by a fall of rock underground; of the two others one was electrocuted by a discharge of electricity from a galvanized iron pipe, and the other was caught in a driving belt.

TABLE V

Analysis of total accidents in the Province of Quebec, 1917.

	Underground		Open Pits		Total	
	No.	%	No.	%	No.	%
MINES:						
Rock falls and slides..	..	..	1	25.0	1	25.0
Cable-derrick.....	..	..	..	..	..	..
Explosive.....	..	..	1	25.0	1	25.0
	..	..	2	50.0	2	50.0
QUARRIES:						
Boom-derrick.....	..	..	..	..	..	..
Rock Falls and Slides.	..	..	..	..	..	..
Explosives.....	..	..	..	..	..	..
	..	..	..	..	..	..
MILLS:						
Bins.....	..	..	1	25.0	1	25.0
Shafting.....	..	..	1	25.0	1	25.0
	..	..	2	50.0	2	50.0
Total.....	..	..	4	100.0	4	100.0

By non-fatal accident the Mines Branch of the Province of Quebec means any accident which incapacitates a man for work for a period of ten days or more but does not cause loss of life.

Owing to the small number of fatal accidents, it is rather difficult to analyse and comment Table V. But if we take it in conjunction with the corresponding table for the preceding year we notice that the most fruitful cause of fatal accidents is falls of rock, either from the walls of underground workings or from the sides of open pits; many accidents are attributable also to the cable-derricks which sway their loads of rock and ore over the heads of the workmen, and to the handling of explosives. Moreover almost each year we have to record fatalities from driving belts and shafts. These last accidents are most unfortunate inasmuch that many could be prevented by a more general use of guards. In most of important factories driving belts are well guarded, more especially those which are driven at high speed. They are surrounded by an appropriate railing or encased in wire screens. The same precautions are taken with pulleys. It may also happen that even smooth shafting, revolving at high speed, may catch men's clothes. Several such occurrences have been recorded which resulted in the death of workmen. Mill foremen should make it a point to insure, by all possible means, protection of the lives of the men under them. Moreover all workmen should make it a point to bring all sources of danger to the attention of their superiors. The construction of protecting devices costs little and is one of the most paying investments by the resulting prevention of accidents and of loss of time and also by the increased efficiency of the workman when he feels himself protected.

The proportions of the various non-fatal accidents classified by their causes are about the same as for the year 1916. Falls of rock are responsible for 33% of these accidents, cable-derricks for 27%, and haulage accidents 16%. This last item shows an increase as compared with last year. It may be ascribed to the new system of transportation adopted at the Jeffrey mine. Accidents due to explosives are not numerous. This is due to the method adopted in practically all the mines of the province to trust only a small number of responsible and well-trained men charged with the care and handling of the explosives; the thawing of the dynamite; the preparation of the cartridges, and other preparations for blasting. In the Report on Mining Operations in the Province of Quebec

for the year 1915 will be found advice and information on storing and thawing of explosives. The approved methods are there described in detail.

TABLE VI

Analysis of non-fatal accidents in mines, quarries and mills of the Province of Quebec in 1917

Mines:	Under-ground	Open Pits	Surface	Total	
				No.	%
Falls of Rock	4	42	1	47	33.6
Cable Derrick	..	38	..	38	27.1
Cars and Tracks	1	..	22	23	16.4
Falls	1	6	1	8	5.7
Explosives	4	2	..	6	4.3
Breaking Rock	..	5	..	5	3.6
Unclassified	..	1	4	5	3.6
Falls of objects	..	3	..	3	2.2
Drilling	..	2	..	2	1.4
Steam Shovel	..	2	..	2	1.4
Boom Derrick	..	1	..	1	0.7
	10	102	28	140	100.0
Quarries:					
Rock falls and slides	..	2	..	2	100.0
Cars and Trucks	..	..	..	..	..
Explosives	..	..	..	..	..
Falls of objects	..	..	..	..	..
Falls	..	..	..	..	..
	..	2	0	2	100.0
Mills and Concentrators	Power Plants	C oncen trators	Machine Shops		
Machines	1	5	2	8	32.0
Falls of objects	..	2	4	6	24.0
Belts and Pulleys	..	4	..	4	16.0
Falls of Rocks	..	3	..	3	12.0
Construction	..	3	..	3	12.0
Unclassified	..	1	..	1	4.0
	1	18	6	25	100.00

It would be to the advantage of all operators to keep full records of all accidents which happen to their men, even of the small and apparently trivial ones, so as to be able to analyse the causes.

TABLE VII

Falls of Rock by Month, 1917

Non-Fatal	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Total
Underground	.....	.....	1	1	1	1	.....	.....	.....	.....	.....	.....	4
Open Pits	3	1	4	5	3	4	4	5	2	1	4	6	42
Quarries	.....	.....	.....	.....	.....	1	.....	.....	.....	.....	1	.....	2
Fatal													
Underground	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Open Pits	.....	.....	.....	.....	.....	.....	.....	1	.....	.....	.....	.....	1
Quarries	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Total	3	1	5	6	4	6	4	6	2	1	5	6	49

Moreover if an operator be desirous of obtaining a reduction in the rates of insurance, he would be greatly helped in proving by such records that accidents in his operations are less numerous than in other similar undertakings. He would be in a position to discuss with strong arguments to support his contentions. The absence of such records would be more likely to result in higher rates of insurance than should prevail.

In the Report of Mining Operations in the Province of Quebec for the year 1916, pages 101 to 105, suggestions will be found which may help to reduce the number of accidents due to falls of rock and to cable-derricks. The operators who may be interested in the subjects might read these suggestions with some profit.

We cannot put too much emphasis on the absolute necessity on the part of all operators to send to the Department a full account of the serious accidents which occur in the course of mining and quarrying operations or in mills connected with such. Mr. A. H. Fay, statistician of the Bureau of Mines of the United States, sums up as follows the reasons why operators should willingly co-operate and help in the collection and compilation of accident statistics.[1]

"The reason for accident statistics is not to show a record of experience, discomfort, pains and sufferings of the employee to hand down to future generations; to furnish statisticians with a set of figures which may be juggled to suit any peculiar whim, nor to provide data for the construction of fancy charts. These, however are necessary adjuncts to the main purpose, viz.: To obtain information by which to diagnose industrial accidents to determine the cause and provide a remedy. Statistical records are absolutely essential as a matter of evidence to prove the guilt of certain mechanical devices, which assault with intent to kill or maim, and to determine with a certain degree of accuracy the personal element entering into the cause of accidents. As in every court of justice, it is necessary to have all the evidence available to find out who is the guilty one in order that proper sentences may be determined.

"Statistics should embody all the information available concerning each accident, if the best results are to be obtained. It is not enough to know that a man fell down a shaft and was killed. Why did he fall down? Who was to blame? Was the shaft properly

[1]Proceedings Sixth Annual Safety Congress. National Safety Congress 1917, P. 1395.

guarded? Could the accident have been avoided? It is the answer to these questions which should be recorded in accident statistics."

The fundamental use of accident statistics is therefore to determine and establish the principal causes of accidents, so as to devise means of preventing their recurrence, and this is to the benefit of the operators and the mine workers. Managers and superintendents of mines should therefore consider it a duty to comply in the fullest with the mining law which requires them to report to the Department in Quebec, as full data as possible of accidents which occur to workmen under them. Return forms are obtainable from the Department of Colonization, Mines and Fisheries, of which the Mines Branch is part.

MINES, QUARRIES AND MILLS—PROVINCE OF QUEBEC

FATAL ACCIDENTS DURING THE YEAR 1917.

No.	Date	Name of Mine	Name of Operator	Name of Victim	Age	Occupation	Nature of Wound	Cause of Accident
1	May 11	British Canadian	Asbestos Corporation of Canada, Limited.	Joseph Demers	41	Mill Foreman	Instantaneous death by electric shock.	Placed his feet on a pipe containing electric wires carrying 2200 volts.
2	June 9	Moss	Dominion Molybdenite Co.	R. H. Edey	31	Powder Man	Instantaneous death	Explosion of dynamite in thaw-house while the victim was inside the building.
3	Aug. 10	Jeffrey	Manville Asbestos Co	Alfred Pinard	33	Driller	Head and other parts of the body crushed.	Several pieces of rock high up on the face above him started to slide down and struck the deceased.
4	Sept. 18	Eustis	Eustis Mining Co.	W. Sage	15	Ore sorter	Neck broken	Wanted to put drive belt on slow speed transmission, he was caught and jammed against timber.

Description of Fatal Accidents

May 11th.—At the British Canadian Mine, Black Lake, Jos. Demers, 41 years of age, at about 15 minutes past five o'clock, was doing some repair work, to a ventilation conduit, when he was electrocuted by coming in contact with a pipe containing some electric wires.

The ventilation duct leads the asbestos dust from a hopper in the basement to the roof. At the time of the accident the men were putting into place a new section of the duct. As it was necessary to rivet two small rivets at the upper end of the 18-in. tube, Demers crawled in to hold a piece of steel against the head of the rivets, while one of his companions went to the next floor above, and a second went for a piece of lumber. When the first man was ready for his work he called to Demers who by this time had found his way into the duct. But for all the noise in the mill he could not say if Demers made any reply. As the second man came back with a piece of lumber, he noticed Demers' feet resting on the electric conduit; at the same instant, this piece of wood touched the conduit and he received a shock. He called to the foreman to cut off the power: which was done. Coming in contact with the pipe a second time, he received another shock. The power was then turned off at the sub-station. Demers was taken from his position apparently dead. The physician practiced artificial respiration on the body for two hours. At first he noticed regular movement of the respiratory system, but no pulsation of the heart. After this lapse of time, the body became stiff. The pipe on which the feet of the victim stood, measures 1¼ in. in diameter. It is in galvanized iron and stamped with the seal of the Underwriters Laboratory Inspected Conduit. It contains three isolated electric copper wires leading the electric current from the transformer to a 100 h.p. motor, under a 2200 voltage. The company's electrician has testified at the coroner's inquest, that the pipe was new, in good order, and also the wires; that the system was grounded, and also that two days previous the pipe was not electrified. Demers' boots were damp and the soles were covered with hob nails. A small burn was noticed under the foot near a toe.

VERDICT—Accidental death by electric shock.

June 2nd.—Richard Howard Edey. Employed at the Dominion Molybdenite Company, Quyon, was working by himself in a small

building, containing a small quantity of dynamite, fuses and detonators, a few hundred feet from the mine, when at about 11.30 a.m., an explosion occurred which reduced the building to pieces. After the accident Edey's body was found at a short distance. As the victim was working alone in the building and was killed instantaneously, it is impossible to get any information on the cause of the accident. In the debris, no clue was found which could throw some light on the case.

Edey was an old miner and had a good experience in handling explosives. As a part of Edey's work was to fix caps on the fuses, one could infer that the explosions occurred while performing this work.

August 10th.—At about 9 o'clock a.m. Alfred Pinard, 34 years of age, driller, was drilling some holes when he was instantaneously killed by a piece of rock which became loose and fell on his head from the side of the pit above where he was working.

Pinard and a companion were running each a drill and were pushing ahead the work started by the night shift. They were at work on a face at a point 40 feet above the railroad track. A natural step was their working place, above which was the vertical face of large block of rock. They were drilling a set of horizontal holes at the base of this block of rock. From testimonies given at the inquest, it would seem that the previous day, Pinard and his companion had scaled the wall above their working place for five hours and that the night shift had continued this special work for 1½ hours; that the stone which fell had had their special attention. It was so wedged in, that nothing could be done with it. Everything seemed all right when the work was resumed in the morning. Some one remarked that early that day, it rained, and water had percolated through the crevices of the stone, and moreover, that at a distance of 40 feet below, a number of block holes had been fired at 5 o'clock that some morning. The above fact together with vibrations of the drill may have had as a result to loosen the rock, and cause its fall.

After being struck, the victim fell from a height of 20 feet. The stone which hit him measured two feet in diameter, and weighed 150 to 175 pounds. The physician upon examining the body, found a compound fracture of the right perietal bone and a large cut above the right eye and a much cut pelvis, and other wounds. The wounds to the head were sufficient to cause death.

VERDICT—Accidental death.

September 18th.—During the afternoon of the 18th, at about 3.10 o'clock, William Edward Sage, 14 years and 10 months of age, was killed while putting into place a belt on a pulley in the mill of the Eustis Mining Company, at Eustis.

The boy was sorting the ore which was passing on a conveyor belt. It very often happens that the feeder which brings the ore to the conveyor carrying the ore from the bin to the crushers stops on account of this belt. It is usual for one of the boys to run to the belt and put it back into place. It was while accomplishing this that the lad was killed. The foreman in charge of this section of the mill noticed the prolonged absence of the boy, and went to see what had happened, and found him laying on the pulley with his head in the belt. This belt is very short. It measures about 10 feet, long and runs slowly; about three revolutions per minute. The physician found upon examination that the boy had a broken neck which was sufficient to cause death, also some scars on his back.

VERDICT—Accidental death.

MINES, QUARRIES AND MILLS—PROVINCE OF QUEBEC

NON-FATAL ACCIDENTS DURING THE YEAR 1917.

No.	Date	Mine or Quarry	Name of Operator	Name of Injured	Age	Occupation	Nature of Wound	Cause of Accident
1	Jan. 5	Jacob's Mine.....	Jacob's Asbestos Mining	P. Churen.....	30	Pit Labourer.....	Cut on head.....	While loading a box in the pit some loose rock fell from the edge of pit striking him on the head.
2	Jan. 8	Jeffrey Mine.....	Manville Asbestos Co., Limited.	Fred Beauchesne...	..	Blacksmith.....	Sprain of lumbar muscles	Sprained his back lifting an iron rail.
3	Jan. 9	Weedon Mine.....	Weedon Mining Company, Limited.	O. W. Slack.....	37	Siding foreman...	Back and left leg badly bruised.	Went down into chute to light up a fuse to blast frozen ore, when the ore began to come down and caught the injured.
4	Jan. 10	Jacob's Mine.....	Jacob's Asbestos Mining Co.	George Croteau....	18	Pit Labourer.....	Right thumb bruised....	While loading a box, caught his thumb between it and rock.
5	Jan. 13	Weedon Mine.....	Weedon Mining Company, Limited.	Louis Baillargeon...	19	Mucker.....	Left ankle badly sprained	By stepping on a rock while at work.
6	Jan. 17	Jacob's Mine.....	Jacob's Asbestos Mining Company.	Alphonse Marchand	27	Pit Labourer.....	Left knee sprained.....	Struck by flying piece of rock.
7	Jan. 23	Jeffrey Mine.....	Manville Asbestos Company Limited.	Emilien Burke.....	..	Derrick Repairer.	Contused wound of left gluteal region.	Got caught between locomotive and dumping stand.
8	Jan. 26	Federal Mine.....	Federal Asbestos Company.	Geo. Auclaire.....	39	Labourer.....	Side of left foot bruised with hemorrhage	Stone rolling down from the bank.
9	Jan. 27	King's Mine.....	Asbestos Corporation of Canada.	Joseph Landry.....	24	Brakeman.....	Cut on left side of face..	Hit by small piece of rock.
10	Jan. 31	King's Mine.....	Asbestos Corporation of Canada.	Joseph Bisson.....	48	Yardman.....	Left eye injured.	Some dust flew into his eye.
11	Feb. 2	Jacob's Mine.....	Jacob's Asbestos Mining Co.	E. Houde.....	18	Pit Labourer	Left foot bruised.....	A wheelbarrow fell on his foot.
12	Feb. 6	Jeffrey Mine.....	Manville Asbestos Company.	Saul Lemire.....	..	Labourer.....	Injury to lower ribs of right side also contusion and abrasions over lumbar region.	Slipped and fell.

13	Feb. 10	King's Mine	Asbestos Corporation of Canada.	Josephat Hebert	40	Crusherman	Chin and lower lip wounded.	While feeding a crusher his crow bar was lifted by jammed rock, hitting him on the chin.
14	Feb. 12	Jeffrey Mine	Manville Asbestos Company-	Anatole Pruneau	..	Boxman	Sprain of abdominal muscles.	His helper let his hand slip off while lifting ock, leaving the full weight on the injured.
15	Feb. 17	Jeffrey Mine	Manville Asbestos Company	Theodule Lefebvre.	..	Mill Labourer	Sprain of back and lower abdominal region.	Slipped while lifting a piece of rock.
16	Feb. 19	King's Mine	Asbestos Corporation of Canada.	Phileas Belleau	59	Driller	Both hands, face and left foot injured.	While loading a block hole with a woodenr od, charge went off.
17	Feb. 20	Jacob's Mine	Jacob's Asbestos Mining Co.	E.Guenette	31	Driller	Right eye bruised	While working a drill some pieces of rock struck him.
18	Feb. 20	Jeffrey Mine	Manville Asbestos Company.	John Prince	..	Miner	Contusion and abrasion of left thumb.	Piece of rock rolled down and caught injured's thumb.
19	Feb. 26	Beaver Mine.	Asbestos Corporation of Canada.	Henri Letourneau.	23	Loader	Back twisted;	When lifting a rock in the box.
20	Feb. 28	King's Mine	Absestos Corporation of Canada.	Josephat Doyon.	21	Labourer	Contusion and wound to left knee.	Crushed between a heavy chain and a rock.
21	Mar. 1	British Canadian	Asbestos Corporation of Canada.	Joseph Poulin	19	Loader	Compound fracture of right leg.	In dumping box into car he got caught between box and a rock.
22	Mar. 3	British Canadian	Asbestos Corporation of Canada.	Adolphe Hardouin	65	Labourer	Right hand sprained	A piece of rock fell from side of pit striking the handle of his shovel and spraining his hand.
23	Mar. 7	King's Mine	Asbestos Corporation of Canada.	Antoine Bellemare	61	Switchman	Third finger of left hand bruised.	While dumping a loaded car, his finger was caught between two iron bars.
24	Mar. 9	Federal Mine	Federal Asbestos Co.	Vital Bisson	18	Labourer	Right leg broken above knee.	Hit by swinging box while hoisted up.
25	Mar. 10	Jacob's Mine.	Jacob's Asbestos Mining Co.	O. Vachon	25	Pit Labourer	Left foot bruised.	A stone rolled down from bank, striking him in the foot.
26	Mar. 13	Martin Bennett	The Martin Bennett Asbestos Mines, Limited	Arthur Routhier.	25		Right foot crushed	Piece of rock fell on his foot.
27	Mar. 21	Eustis Mine	Eustis Mining Co.	G. Biron	19	Labourer	First joint right thumb crushed.	Stone rolled down from pile.
28	Mar. 26	Federal Mine	Federal Asbestos Co	Theodule Bisson	22	Labourer	Sprain to right ankle.	In jumping from car.
29	Mar. 26	Federal Mine	Federal Asbestos Co.	Mick Iwassisen.	34	Labourer	Right limb bruised at knee	By stone rolling from bank.
30	Mar. 31	Federal Mine	Federal Asbestos Co	Oscar Falardeau.	34	Labourer	Right thumb broken	While rolling a stone in a box, another meant to throw a stone in the same box and instead hit the injured.
31	April 3	King's Mine.	Asbestos Corporation of Canada.	Wilfrid Lessard.	19	Labourer	Index finger of left hand bruised.	By rock while placing same into a box car.

No.	Date	Name of Mine	Name of Operator	Name of Victim	Age	Occupation	Nature of Wound	Cause of Accident
32	April 5	King's Mine	Asbestos Corporation of Canada.	Napoleon Gilbert	26	Labourer	Toes of right foot bruised.	A hoist box while in motion struck his foot.
33	April 11	Jacob's Mine	Jacob's Asbestos Mining Company.	Jos. Goodson	19	Tinsmith	Piece of flesh removed from tip of finger.	Struck his finger with claw hammer.
34	April 11	King's Mine	Asbestos Corporation of Canada.	Theodore Grondin	45	Labourer	Eye injured	Left eye injured by a small piece of rock while breaking rock with hammer.
35	April 13	Federal Mine	Federal Asbestos Co.	Edmond Nadeau	25	Labourer	Shoulder bruised internally.	Rock rolled down from side and squeezed him against box.
36	April 14	Beaver Mine	Asbestos Corporation of Canada.	Gedeon Leblond	53	Loader	Left leg injured	Struck by a stone on his leg.
37	April 16	Jacob's Mine	Jacob's Asbestos Mining Co.	O. Fortier	18	Pit Labourer	Sprain and contusion of right knee.	The injured man fell on a stone.
38	April 18	Jacob's Mine	Jacob's Asbestos Mining Co.	J. Poudrier	43	Pit Labourer	Two smallest toes of right foot bruised.	While loading a box he let a rock fall on his toes.
39	April 25	British Canadian	Asbestos Corporation of Canada.	Narcisse Fournier	28	Labourer	Leg fractured	A piece of loose rock came down the jam in the pit and struck him.
40	April 26	Zinc Mine	Zinc Company, Limited	Simeon Lefebvre	30	Machine man	Bruise on instep of right foot.	Small rock fell from roof of stope.
41	April 28	Martin Bennett	The Martin Bennett Asbestos Mines.	J. B. Goudreau	39		Cut on head and strained back.	Was caught by a slight slide of rock.
42	April 30	Johnson's	Johnson's Company	Philemon Landry			Scalp wounds and collar bone fractured.	A stone from side of pit struck him on back of neck, causing him to lose his balance and fall about twenty feet.
43	May 3	Martin Bennett	The Martin Bennett Asbestos Mines Limited	Georges Gagné	56	Labourer	Lost sight of right eye	Small pieces of rock hit the eye.
44	May 5	Martin Bennett	The Martin Bennett Asbestos Mines Limited		47	Labourer	Left foot bruised by rock	While loading rock into mine car piece fell from his hand on to his foot.
45	May 18	King's Mine	Asbestos Corporation of Canada.	Emile Paquin	27	Loader	Right foot sprained	Struck by a piece of rock from jam.
46	May 18	Johnson's	Johnson's Co.	Napoleon Mercier	30	Labourer	Deep scalp wounds and sprained feet and hands	Fell off scaffolding of a derrick about twenty feet.
47	May 21	Eustis Mine	Eustis Mining Co.	Ezra Hallam	18	Labourer	Left leg broken above knee.	Struck by falling loose rock underground.
48	May 22	British Canadian	Asbestos Corporation of Canada.	Joseph Cloutier	18	Labourer	Scalp wound	A small piece of rock struck him on the head.

49	May 24	King's Mine	Asbestos Corporation of Canada.	Antoine Landry	17	Labourer	Second toe of left foot injured.	His foot was caught between two pieces of wood while dumping car.
50	May 28	Jacob's Mine	Jacob's Asbestos Mining Co.	E. St. Hilaire	33	Pit Labourer	Nose badly cut and bruised.	Some loose rock fell from edge of pit.
51	May 29	Jacob's Mine	Jacob's Asbestos Mining Co.	J. B. Couture	69	Mill Labourer	Right leg badly bruised above knee left leg cut and bruised.	While passing near a shaft, in motion his overall caught in the shaft throwing him down.
52	June 4	Jeffrey Mine	Manville Asbestos Co.	John Marquis	49	Box Man	Laceration of left hand	Rock rolled over his hand.
53	June 7	Quyon Mine	Dom. Molybdenite Co.	John O'Malley	..	Pumpman	Both hands burned slightly.	Spilled gazolene on lantern setting fire to pumphouse.
54	June 13	British Canadian	Asbestos Corporation of Canada.	Desire Turmelle	18	Labourer	Scalded by steam	When he started up hoist a steam pipe cracked.
55	June 14	Federal Mine	Federal Asbestos Co.	Jean Nadeau	64	Labourer	Right ankle broken	Stone rolling off bank.
56	June 16	Quyon Mine	Dom. Molybdenite Co.	Arthur Lebrun	23	Engineman	Compound fracture above and extending into the elbow of right arm.	Starting a steam engine when the eccentric rod broke, flew up and struck the engineer above right elbow.
57	June 16	Beaver Mine	Asbestos Corporation of Canada.	Joseph Lachance	36	Labourer	Back bruised.	A stone which rolled from the side of the pit, struck him on the back.
58	June 16	Johnson's	Johnson's Co	Nap. Gamache	27	Labourer	Scalp wound and bruised shoulder.	Allowed car to start down on steep grade without engine lost control and was thrown against another car.
59	June 16	Bell Mine	Bell Asbestos Mines	L. Drouin	14	Cobber	Third finger of right hand bruised.	When knocking down vein of of crude asbestos with steel wedge, he jammed his finger between rock and wedge.
60	June 20	Jeffrey Mine	Manville Asbestos Co.	Aimé Bourassa	21	Labourer	Abrasion of right cornea	While cutting rods of iron with a saw small particle of iron flew into his eye.
61	June 20	Federal Mine	Federal Asbestos Co.	Albert Yendruck	44	Labourer	Right hand thumb broken.	Flat stone fell off the wall on shovel handle
62	June 20	King's Mine	Asbestos Corporation of Canada.	Joseph Marceau	32	Oiler	Second finger of left hand injured.	While greasing a piece of machinery he cut his finger.
63	June 20	King's Mine	Asbestos Corporation of Canada.	Alfred Ouellet	38	Labourer	Left foot bruised	Box struck his foot.
64	June 28	Eustis Mine	Eustis Mining Co.	Wm. Elliott	30	Miner	Simple fracture of femur left.	Elliott was taking down a piece of loose in the roof, he did not bring it down, he placed his ladder right under it when it came loose and slid down the ladder striking his leg.
65	June 29	Granite Quarry	Joseph Brunet	Fred Savaria	30	Quarryman	Little finger of left hand broken.	While moving a stone, it slid and caught his finger.

No.	Date	Name of Mine	Name of Operator	Name of Victim	Age	Occupation	Nature of Wound	Cause of Accident
66	July 3	Jeffrey Mine.....	Manville Asbestos Co...	Joseph Lambert....	20	Labourer.....	Contusion of right foot..	While taking down cable same fell and struck his foot.
67	July 5	Jeffrey Mine.....	Manville Asbestos Co....	John Boucher.....	26	Labourer.....	Severe contusion of left wrist.	Piece of rock fell on his wrist.
68	July 6	Weedon Mine.....	Weedon Mining Company, Limited.....	Matten Elm.....	23	Driller.....	Right arm broken at wrist, right eye badly cut.	In cleaning a place to set machine in a stope he struck some loose powder which caused an explosion.
69	July 6	Weedon Mine.....	Weedon Mining Company Limited;	Owen Provencher...	19	Machine Helper..	Both eyes badly cut....	In cleaning a place to set machine in a stope he struck some loose powder which caused an explosion.
70	July 7	Johnson's Mine....	Johnson's Co.....	Evang. Turcotte....	32		Bruised thumb of right hand.	While moving stone another piece fell on his hand.
71	July 9	Jeffrey Mine.....	Manville Asbestos Company, Limited.	Napoleon Dubois...	44	Track man.....	Severe laceration finger right hand.	Got finger lacerated handling iron rails.
72	July 10	Jacob's Mine.....	Jacob's Asbestos Mining Company.	G. Vaillancourt.....	19	Pit Labourer.....	First finger of left hand jammed.	While loading a derrick box; he had his finger caught between a stone and the box.
73	July 10	British Canadian...	Asbestos Corporation of Canada.	Alex Boucher.....	36	Labourer.....	Left leg fractured.....	Standing on a rock while drilling, he slipped between two rocks.
74	July 11	Jacob's Mine.....	Jacob's Asbestos Mining Co.	Henry Bailey.....	30	Car Loader.....	Left knee sprained.....	While loading a car with asbestos some of the bags fell on his leg.
75	July 11	Bell Mine.....	Bell Asbestos Mines....	Wilfrid Vachon.....	17	Drill Helper.....	Third finger of right hand bruised.	The chuck bushing of the drilling machines started to run and caught his finger.
76	July 13	Johnson's Mine....	Johnson's Co.....	André Laprise.....	28	Labourer.....	Bruised left foot.	A large piece of rock was being moved and it canted, falling partly on his left foot.
77	July 16	King's Mine.....	Asbestos Corporation of Canada.	F. Fabre.....	48	Labourer.....	Fourth finger right hand bruised.	Had finger caught between two derrick boxes.
78	July 17	Bell Mine.....	Bell Asbestos Mines Co.	Joseph Filteau.....	46	Pit Labourer.....	Compound fracture of his right leg.	A small stone fell out the box and hit his leg above the knee.
79	July 18	Jeffrey Mine.....	Manville Asbeston Company, Limited.	Ludger Lefebvre....	29	Driller.....	Severe contusion of l ttle finger	Piece of rock fell on his finger.

80	July	20	Zinc Mine	Zinc Company Limited	Ferdinand Laverrière	26	Machineman	Slight cuts on leg	While drilling large boulders in stope, drilled into mis-hole, explosion resulted.
81	July	20	Zinc Mine	Zinc Company Limited	Oscar Tremblay	26	Machineman	Right hand practically torn off.	While drilling large boulders in stope, drilled into missed hole,explosion resulted.
82	July	24	Jeffrey Mine	Manville Asbestos Company, Limited.	Edmond Vincent	21	Fireman	Fracture of lower jaw, both eyes badly ecchymosed, back of head and neck badly bruised.	Was cleaning a dump car when same closed and caught him by the neck.
83	July	24	Laprairie Plant	Laprairie Brick Company Limited.	Adelard Bisaillon	16	Steam Hammer Boy.	Thumb and two other fingers cut off	Used his hand to brush scales off die block of steam hammer instead of broom.
84	Aug.	1	Jeffrey Mine	Manville Asbestos Company, Limited.	John Purcell	20	Bagger	Punctured sole right foot.	Stepped on nail.
85	Aug.	1	Beaver Mine	Asbestos Corporation of Canada.	Leonidas Ferland	18	Labourer	Left hand cut	In falling on stone.
86	Aug.	2	Chrome Mine	Quebec Asbestos and Chrome Co.	Clair Cadotte	30	Ore Sorter	Tips of three fingers of right hand smashed.	His hand was caught between rope and sheave.
87	Aug.	4	Beaver Mine	Asbestos Corporation of Canada.	Odilon Portelance	37	Labourer	Left thumb cut	Was dumping boxes into cars and had thumb caught.
88	Aug.	6	Bell Mine	Bell Asbestos Mines	HermenegildeGilbert	31	Drill Runner	Back and right hip badly contused.	While barring down loose he fell down a distance of sixty feet.
89	Aug.	8	Jeffrey Mine	Manville Asbestos Co.	Cyril Aube	48	Fireman	Compound fracture of middle right finger	While lifting jack at steam shovel.
90	Aug.	13	Beaver Mine	Asbestos Corporation of Canada.	Georges Cannie	58	Labourer	Left foot bruised	Had his foot caught in a slide of rock.
91	Aug.	16	Jacob's Mine	Jacob's Asbestos Mining Company, Limited.	F. McCraw	42	Contractor	Third finger of left hand cut off.	While chaining a box in the pit had finger caught.
92	Aug.	16	Jacob's Mine	Jacob's Asbestos Mining Company, Limited.	A.Dery	22	Pit Labourer	Left arm torn and bruised several bruises on left side of chest.	The hook of a swinging chain caught his arm, tearing the flesh and striking him on the chest.
93			Boston Mine	Anglo-Canadian Export Co.	M. Groleau	14	Cart Driver	Scratched face and bruises.	Was sitting on beam of derrick when engineer started the hoist, the tightening of the cable knocked Groleau into the pit.
94	Aug.	16	Jacob's Mine	Jacob's Asbestos Mining Co.	Emile Doyon	17	Pit Labourer	Left leg bruised	While cleaning the track, a skip struck him on the leg.
95	Aug.	32	British Canadian	Asbestos Corporation of Canada.	Adelard Turmel	23	Brakeman	Cut and bruised left thumb and major finger.	In coupling cars had hand caught between draw bars.
96	Aug.	27	Belmina Mine	Jos. M. Johnson	Alfred Gilbert	27	Drill Runner	Cut on head	Struck by guyrope when a boom derrick fell.

No.	Date	Name of Mine	Name of Operator	Name of Victim	Age	Occupation	Nature of Wound	Cause of Accident
97	Aug. 29	Bell Mine	Bell Asbestos Mines Co	Omer Roussin	23	DrillHelper	Contusion on back and cut to brow.	Was thrown down the pit by hoisting rope of cable derrick when trying to pull the slack.
98	Aug .29	Jeffrey Mine	Manville Asbestos Company, Limited.	Urbain Renault	16	Driller	Contused wound and sprain of right hand or wrist.	Unknown.
99	Aug. 29	Beaver Mine	Asbestos Corporation of Canada.	William Matteau	49	Labourer	Right leg struck by stone	While loading a box a stone fell from jam.
100	Sept. 1	King's Mine	Asbestos Corporation of Canada.	Presque Plante	30	Labourer	Left hand cut	On a piece of iron.
101	Sept. 3	Eustis Mine	Eustis Mining Company.	Ed. Humphrey	14	Labourer	Fracture of left foot above ankle.	In walking on conveyor belt, his foot went through fasteners and was pulled against an idler.
102	Sept. 4	Jacob's Mine	Jacob's Asbestos Mining Co.	Willie McCraw	18	Pit Labourer	Contusion of muscles of the neck.	While loading a derrick-box, a rock fell from edge of pit striking him on the back of the neck.
103	Sept. 4	Jacob's Mine	Jacob's Asbestos Mining Co.	Aug. Metivier	55	Cobber	Index finger of left hand bruised and cut.	Was cobbing when the hammer slipped, striking his finger and bruising same.
104	Sept. 10	Windsor Mine	Windsor Asbestos Mining Co.	Onesime Lapointe	54		Rupture	Slipped while carrying a hod of brick, displacing a truss causing old rupture to come out.
105	Sept. 10	Johnson's	Johnson's Company.	Georges Lemay	..	Labourer	Left hand partly lacerated from little finger to wrist.	While oiling a dryer he must have slipped as his hand was nipped between the cylinder and bearings.
106	Sept. 11	King's Mine	Asbestos Corporation of Canada.	Aime Vermette	18	Labourer	Had medium finger crushed.	While loading a piece of iron on a truck, he had his finger caught between a bar and the truck.
107	Sept. 12	Johnson's Mine	Johnson's Company.	George Goodson	..	Driller	Bruised left foot	In chaining a rock, the chain slipped and struck him on left foot.
108	Sept. 13	Johnson's Mine	Johnson's Company.	Alex. Bimbak	45	Labourer	Hand bruised	Caught hand between two rocks.
109	Sept. 15	Jeffrey Mine	Manville Asbestos Company, Limited.	Adelard Ouellette	20	Trackman	Contused wound of index finger, nail removed	While dumping cars, got finger caught in some way.

110	Sept. 19	Bell Mine	Bell Asbestos Mines	Thomas Farmer	39	Car loader	Cut on his brow	Injured fell off a platform twelve feet high when dumping a box of ore in a car.
111	Sept. 19	Johnson's Mine	Johnson's Company	Ernest Blouin	25	Labourer	Fracture of jaw	In trying to separate two boxes with a crow bar was struck on jaw with same.
112	Oct. 1	Weedon Mine	Weedon Mining Company, Limited.	Wilfrid Courchesne	32	Bucket Tender	Sprain of back, ligaments of spine.	Tramway bucket broke pulling man into ore bin, head first, a fall of about ten feet.
113	Oct. 1	Bell Mine	Bell Asbestos Mines	Edmond Therrien	48	Pit Labourer	Testicles injured (Ruptured)	Injured fell on a log on the roof of main tunnel.
114	Oct. 2	Jeffrey Mine	Manville Asbestos Co., Limited.	Elphege Plamondon	22	Carpenter	Severe contusion of right leg.	A rock fell and struck man on the leg.
115	Oct. 9	Jeffrey Mine	Manville Asbestos Company, Limited.	Amedee Bouchard	32	Crusher Feeder	Burn of 3rd and 4th degree.	Leg caught in shaft and pulled into same.
116	Oct. 10	Jeffrey Mine	Manville Asbestos Company, Limited.	Evangeliste Cryenne	22	Brakeman	Compound fracture of finger nail removed.	Finger caught between links while coupling cars.
117	Oct. 10	Jeffrey Mine	Manville Asbestos Company, Limited.	Delia Dion	31	Loader and Shipper.	Fracture of oscalis back of heel,	Bag of asbestos, while passing down loaded skip, in some way, struck man on the foot.
118	Oct. 10	Jeffrey Mine	Manville Asbestos Company, Limited.	Arsene Langlois	51	Boxman	Severe contused wound 3rd finger right hand.	Caught between edge of box and piece of rock.
119	Oct. 10	Windsor Mine	Windsor Asbestos Mining Company, Limited.	Emile Boucher	..	Tinsmith	Concussion to left hip and bruise to head.	Fell from dust collector twelve feet high, due to dizziness through indigestion.
120	Oct. 18	Bell Mine	Bell Asbestos Mines	Antoine Gauvin	18	Pit Labourer	Left leg fractured	When hoisting a box it swung around and jammed his left leg against a big stone.
121	Oct. 19	Jacob's Mine	Jacob's Asbestos Mining Co.	Willie Fortier	30	Pit Labourer	Left arm broken, head	A piece of timber fell from edge of pit striking him on arm.
122	Oct. 22	Jacob's Mine	Jacob's Asbestos Mining Co.	Honore Guay	41	Sand Shoveller	Injury to back	Buried in sand slide.
123	Oct. 22	British Canadian	Asbestos Corporation of Canada.	Jos. Sliges	35	Labourer	Bruised on left leg	One of the cables fell in the pit and hit him on left leg.
124	Oct. 26	Beaver Mine	Asbestos Corporation of Canada.	Gabriel St. Pierre	41	Labourer	Right wrist cut	While loading stone one fell from box and cut his wrist.
125	Oct. 30	Jeffrey Mine	Manville Asbestos Company, Limited.	John Purcell	20	Loader	Lacerated wound on little finger of left hand.	While loading car, foot slipped throwing man forward and in attempting to save himself caught his hand on a piece of tin.
126	Oct. 31	King's Mine	Asbestos Corporation of Canada.	Albert Pinard	56	Carpenter	Right foot injured	A heavy box fell on his right foot.

No.	Date	Name of Mine	Name of Operator	Name of Victim	Age	Occupation	Nature of Wound	Cause of Accident
127	Nov. 2	Jeffrey Mine.....	Manville Asbestos Company, Limited.	Hormidas Bastarche	39	Brakeman.....	Contusions over upper right side, right shoulder and upper arm.	While working dumping cars, was caught between moving car and mill building, in a space of one foot wide.
128	Nov. 2	Beaver Mine.....	Asbestos Corporation of Canada.	Gedeon Carrier.....	19	Labourer.....	Left foot badly smashed	While coupling cars, his foot was caught between locomotive wheel and track.
129	Nov. 3	British Canadian...	Asbestos Corporation of	Stanislas Hebert....	62	Labourer.....	Bruise on left foot.....	A stone rolled down from the rock jam and struck his left foot.
130	Nov. 5	Jeffrey Mine.....	Manville Asbestos Company, Limited.	Barrome Girouard..	20	Shipper.....	Abrasion of ring finger with infection.	While piling asbestos fibre in a car, scratched his hand on a wire.
131	Nov. 9	King's Mine.....	Asbestos Corporation of Canada.	Octave Roy.....	51	Labourer.....	Left shoulder injured..	Struck his shoulder on a piece of wood in lifting a piece of iron.
132	Nov. 10	Jeffrey Mine.....	Manville Asbestos Company, Limited.	Germain Delisle....	18	Repairer.....	Contusion in upper part of thorax.	While repairing derrick, slipped and fell a distance of from 12 to 15 feet.
133	Nov. 12	Jacob's Mine.....	Jacob's Asbestos Mining Co.	D. Leroux.....	18	Pit Labourer....	Left knee sprained and bruised, bruises on face and elbow.	While hoisting a large rock, into a box, the rock broke and fell back on him, striking him on the face and right knee.
134	Nov. 14	Beaver Mine.....	Asbestos Corporation of Canada.	Jos. Veilleux.....	35	Labourer.....	Left leg bruised.	While loading a box in the pit a rock fell from the side and struck him.
135	Nov. 15	Granite Quarry....	James Brodie.....	Donald McDonald..	..	Paving cutter....	Two toes partly smashed and bruised.	Was breaking stone when same dropped on his foot.
136	Nov. 15	King's Mine.....	Asbestos Corporation of Canada.	Theo. Grondin.....	45	Foreman.....	Right foot bruised.....	By a stone which fell from side of pit.
137	Nov. 15	King's Mine.....	Asbestos Corporation of Canada.	Cyril Bisson.....	45	Labourer.....	Right wrist and hand bruised.	Caught between piece of machinery and hoisting cable.
138	Nov. 15	Bell Mine.....	Bell Asbestos Mines....	Joseph Pigeon.....	40	Labourer.....	Fourth finger of right hand badly bruised.	When placing the box on floor of pit, jammed his finger between stone and box.
139	Nov. 16	Jeffrey Mine.....	Manville Asbestos Company, Limited.	Benjamin Plourde..	34	Driller.....	A very severe contusion of right hip.	While at work drilling, a piece of piping became undone and carried victim with it down a very steep incline.

140	Nov. 16	Weedon Mine.....	Weedon Mining Company, Limited.	Joseph Surprenant..	24	Loading cars.....	The pressure on kidneys, gives an acute pain and a bruise is marked below right eye.	In trying to apply brake on car he fell from top to floor of car.
141	Nov. 16	King's Mine.....	Asbestos Corporation of Canada.	Thomas Paradis....	56	Machinist.....	Right foot bruised.....	A piece of wood fell on his foot.
142	Nov. 16	Fraser Mine.....	Asbestos Corporation of Canada.	Oliver Vachon.....	35	Labourer.....	Right hand second joint finger sprained.	Fell backward on his hand and forced finger back.
143	Nov. 17	King's Mine.....	Asbestos Corporation of Canada.	Laureat Gagné.....	24	Machinist.....	Fourth finger bruised....	The chuck of a drill fell on his finger while repairing it.
144	Nov. 23	Fraser Mine.....	Asbestos Corporation of Canada.	Gedeon Cliche.....	16	Oiler.....	Cut between first and second fingers left hand	His hand was caught between edge of two buckets.
145	Nov. 27	Jeffrey Mine.....	Manville Asbestos Company, Limited.	Ernest Boucher....	36	Box man.....	Laceration and contusion of little finger also abrasion of third finger.	While loading derrick box a rock fell on his hand crushing it on the edge of box.
146	Nov. 28	Jeffrey Mine.....	Manville Asbestos Company, Limited.	Gerard Boutin.....	18	Brakeman.....	Severe contusion of right foot.	Caught foot in chain between cars, causing a bad fall.
147	Nov. 29	Jeffrey Mine.....	Manville Asbestos Company, Limited.	Elphege Charpentier	24	Mill Labourer...	Contusion of left foot and ankle.	While at work at crusher in mill, a large piece of rock fell pinning his foot between the crusher and stone.
148	Nov. 29	King's Mine.....	Asbestos Corporation of Canada.	Telesphore Leblond.	36	Labourer.....	Right side of face injured	A belt broke while replacing same.
149	Dec. 1	Jacob's Mine.....	Jacob's Asbestos Mining Co.	A. Larochelle.....	35	Driller.....	Left foot fractured and bruised.	Got his foot caught between a rock and drill.
150	Dec. 3	Jeffrey Mine.....	Manville Asbestos Company, Limited.	Ulderic Morin.....	21	Driller.....	Lacerated wound 3rd finger right hand, nail split through.	Finger caught between large piece of rock and crowbar.
151	Dec. 3	King's Mine.....	Asbestos Corporation of Canada.	Antoine Auclair....	20	Labourer.....	First and second toes of right foot bruised.	A heavy shaft fell on his foot while he was moving it.
152	Dec. 3	Ling Mine.....	Quebec Asbestos Corp..	Emile Dodier.....	23	Boxman.....	Lost sight of one eye....	Struck in face by blast while investigating a missed hole.
153	Dec. 4	Johnson's Mine...	Johnson's Company....	Robert Jamieson...	48	Foreman.....	Severe contusion of left eye.	While breaking down a piece of frozen clay he got a piece of it in the eye.
154	Dec. 4	Jeffrey Mine.....	Manville Asbestos Company, Limited.	Siméon Renault....	19	Brakeman.....	Contused wound of little finger.	Finger caught while coupling cars.
155	Dec. 6	Jacob's Mine.....	Jacob's Asbestos Mining Co.	L. Marois.....	51	Cobber.....	Left hand bruised.....	While trying to put a belt in motion with a stick the stick flew back and struck him on the hand.
156	Dec. 6	King's Mine.....	Asbestos Corporation of Canada.	Ovide Emond.....	23	Labourer.....	Right thigh fractured...	A heavy box slipped on his thigh.
157	Dec. 7	British Canadian..	Asbestos Corporation of Canada.	Francois Garon.....	60	Labourer.....	Left foot bruised.....	A box fell on his foot.
158	Dec. 11	Sterrett Mine....	Quebec Asbestos and Chrome Co.	Joe Sirois.....	19	Cartender.....	Foot crushed.....	By heavy stone which fell a short distance.

No.	Date	Name of Mine	Name of Operator	Name of Victim	Age	Occupation	Nature of Wound	Cause of Accident
159	Dec. 13	Jeffrey Mine.....	Manville Asbestos Company, Limited.	Hormidas Boucher.	32	Labourer.....	Severe contusion of upper cord of left tibia.	While dumping cars he slipped and fell hurting his knee on frozen ground.
160	Dec. 15	Jeffrey Mine.....	Manville Asbestos Company, Limited.	Jos. Girouard.....	19	Labourer.....	Avulsion of right arm...	Caught between two moving locomotives.
161	Dec. 15	Bell Mine.....	Bell Asbestos Mines.....	William Cote.....	62	Labourer.....	Compound fracture of right arm.	When hoisting a big stone it threw him against the jam and fractured his arm.
162	Dec. 15	Jacob's Mine.....	Jacob's Asbestos Mining Co.	Donat Gregoire....	17	Pit Labourer.....	Index finger of right hand bruised.	When loading boxes in pit, a rock slipped from his hand, bruising his finger.
163	Dec. 19	Bell Mine.....	Bell Asbestos Mines....	Etienne Jolin.....	68	Pit Labourer....	One rib fractured.....	When hoisting a big stone it swung around the pit, and threw him down.
164	Dec. 21	Jacob's Mine.....	Jacob's Asbestos Mining Co.	A. Nadeau.....	19	Pit Labourer....	Contusion, and small cut on right side of right eye contusion of right shoulder.	When drilling a rock fell from the side of the pit striking the injured man on the right shoulder and right eye.
165	Dec. 21	Jacob's Mine.....	Jacob's Asbestos Mining Co.	Pierre Perron.....	51	Pit Foreman.....	Two cuts, each three inches long on head, also cut on nose.	The injured man was barring loose rock on a steep wall when his foot slipped and he fell on his head.
166	Dec. 22	Jeffrey Mine.....	Manville Asbestos Company Limited.	Wm. Toutant.....	28	Driller.....	Contused wound of little and third finger of left hand.	A large piece of rock fell on his hand.
167	Dec. 26	Jeffrey Mine.....	Manville Asbestos Company, Limited.	Edmond Nault.....	..	Steam Shovel operator..	A burn on the left forearm	While at work on steam shovel some hot water and hot oil spilled on his arm.

GEOLOGY OF A PORTION OF THE PROJECTED TOWNSHIP OF LEMIEUX, COUNTY OF GASPE, P.Q.[1]

COMPRISING A DESCRIPTION OF THE ZINC AND LEAD DEPOSITS AT THE HEAD OF BERRY MOUNTAIN CREEK, A TRIBUTARY OF THE GREAT CASCAPEDIA RIVER

by Adhémar Mailhiot.

INTRODUCTION

The Gaspé peninsula is bounded on the north by the river St. Lawrence, on the east by the gulf of St. Lawrence, and on the south by the Baie des Chaleurs. It covers an area of about 11,000 square miles. Properly speaking, it consists of the county of Gaspé, which, with the county of Bonaventure, comprises the greater portion of the land. The county of Matane, to the west of that of Gaspé, also extends into the interior of the peninsula. This interior of the great peninsula consists of rugged, well-timbered hills, and the coast region, 12 miles in width at the most, is the only settled portion. The majority of the inhabitants earn their livelihood by fishing in summer and by lumbering in winter. In some regions, such as those at the mouth of the principal rivers or along the Baie des Chaleurs, are areas of tilled land. The cleared portion along the coast is only a few miles wide.

The region forming the subject of this report is situated at the head of the Brandy and Berry Mountain creeks, tributaries of the Great Cascapedia river and constitutes the northern part of the projected township of Lemieux in the county of Gaspé. (See the index map, p. 120). It is 40 miles distant in a straight line from the mouth of the Great Cascapedia river, which falls into the Baie des Chaleurs, and 30 miles from the mouth of the St. Anne river, which falls into the river St. Lawrence. It connects with the Quebec and Oriental railway at Cascapedia by a lumber road 50 miles long leading from the Federal Zinc and Lead Company's mine to the station.

[1]Translated from the French.

This report, and the map accompanying it are the result of two months field work during the summer of 1917, devoted to the study of the northern part of the projected township of Lemieux in the interior of which deposits of zinc blende and galena were discovered.

The discovery was made in the autumn of 1910 at the spot where the present shaft of the Federal Zinc and Lead Company is situated on a hill some hundred feet from the right bank of the Berry mountain creek. Mr. James McKinley staked the deposit in the name of the New Richmond Prospecting and Mining Company (afterwards the North America Mining Company), which did some prospecting work during the following years. In 1915, Messrs. Lyall, Maher and Beidelman took out a lease of the property and at once started mining operations. They have just formed a company called "The Federal Zinc and Lead Company". Since 1915 all the lots in the vicinity of the original deposit have been staked out by one or the other company.

This report gives only a summary and general description of the leading geological features of the district and may be considered rather as a preliminary report. The region, very well timbered and covered with a thick layer of moss and of vegetable debris, is at times almost impassable owing to the accumulation of windfalls. Under such conditions the mapping of the geological contacts was effected very slowly and with the imperfections due to having to measure by pacing and to survey with the prismatic compass. We did not observe any perceptible variation of the magnetic declination, which is 25° 24′, as indicated by Mr. J. P. Gastonguay, land surveyor, and verified by us.

The maps we had at our disposal were those of the mining claims and that of the Great Cascapedia river and its principal tributaries—the Brandy creek among others; the first of these streams was surveyed in 1901 by Mr. Geo. P. Roy and the second in 1912 by Mr. J. M. Roy, both Provincial land-surveyors. The Berry mountain creek has not been surveyed. To connect the claims with the river we ran a stadia line, along the portage road, from the mouth of Brandy Creek to the Federal Zinc and Lead Company's mine. This line was, moreover, to serve as a base for our subsequent operations.

I was assisted in this work by Mr. Conrad Manseau, a professor of the Montreal Polytechnic School, to whom I wish to express my high appreciation of the effective work he performed and to whom

I must also give credit for the drafting of the map. Mr. Aimé Fauteux, a student of the Polytechnic School, was of great assistance in connection with the survey work. I wish also to express my thanks to the officers and shareholders of the Companies owning the mines for their courtesy towards me and for the many services they rendered me in the performance of my work.

Geographical Position and Means of Communication

The projected township of Lemieux is situated in the county of Gaspé at the head of the Brandy and Berry Mountain creeks. Its area is 150 square miles. The group of staked claims occupies the northern part of this township and forms a strip of land about 100 chains wide and 240 chains long. The aggregate area, shown on the map of the claims, is 2026 acres.

From Montreal or Quebec, the Intercolonial Railway runs to Matapedia Junction at the head of the Baie des Chaleurs. From there the Quebec and Oriental Railway takes one to Cascapedia, 60 miles from Matapedia. Cascapedia is situated at the mouth of the Great Cascapedia river and is the nearest railway station to the mine. From there a good wagon road leads to Esquimenac, a small village 6 miles inland, where the buildings of the Great Cascapedia Salmon Club are. There one enters the forest, in that part of the region not subdivided into farming lots. A lumber winter road opened by the timber limit owners, Messrs. Montgomery in particular, and in bad condition in summer, follows the valley of the Great Cascapedia river to its forks, and then runs along the lake branch. The distance from Cascapedia to the forks is about 40 miles. The journey by wagon from the houses at Esquimenac to the forks, takes two days and a half. Along the road are lumber camps where one may lodge at night. The first camp, called "Joe Martin's," is 16 miles from Cascapedia station; Douglas', 25 miles; the Falls' camp, 30 miles; and the Berry mountain 36 miles. During the spring freshets, the water overflows on the low places at the head of the valley and completely covers the road which is impassable for wheeled vehicles until near the end of June. At the forks, the Montgomery camp road is left and the portage road to the mine, is taken. This road follows the Salmon branch of the Cascapedia river for about 1½ miles to within a short distance from the mouth of the Brandy creek and then runs diagonally to strike

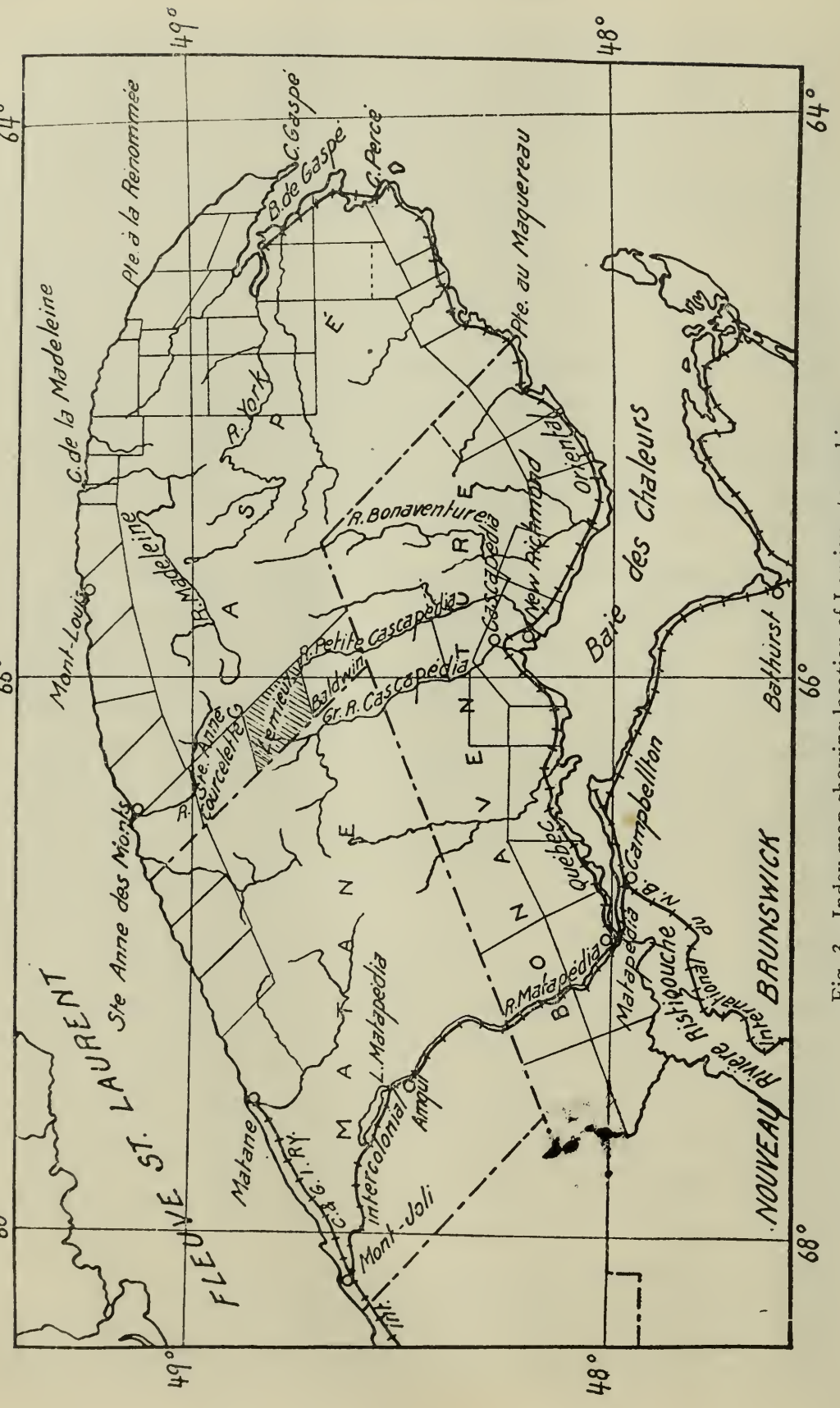

Fig. 3—Index map showing location of Lemieux township.

the Berry mountain creek, 8 miles from the forks. This portage road was opened during the winter of 1915-1916 by the Federal Zinc and Lead Company for hauling the boilers and compressors needed for working their mine. The distance from the forks of the river to the mine is about 10 miles. This road is barely passable for wheeled vehicles owing to a swamp, between the 3rd and 5th miles from the forks, where water remains throughout the summer. At the date of our visit, the Federal Zinc and Lead Company was laying out another road to avoid this swamp. It will start from the Montgomery road at the mouth of the Berry mountain creek and join the old portage road at the 6th mile from the river forks. It is claimed that this will reduce the distance by 4 miles. At the 8th mile, the portage road strikes the Berry mountain creek and follows it to the foot of the hill on which the Federal mine buildings stand. To ascend this hill it follows a small brook with a very steep slope, the difference in level being 410 feet in a distance of about three-fourths of a mile.

Previous Explorations and Field Work in Cascapedia

In 1844, Sir William Logan made a cross-country exploration from the river St. Lawrence to the Baie des Chaleurs. He ascended the Cap Chate river to the forks, then he portaged through the forest *via* Go-Ashore creek and Conical mountain to the branch of the lake of the Great Cascapedia river, which he descended to its mouth. In 1845, Mr. Murray surveyed the Ste. Anne-des-Monts river to the forks. He also ascended the Bonaventure river to the upper forks and surveyed the St. John or Douglastown river.

In 1857, Mr. Richardson surveyed the Magdalen river and made several explorations between its streams and those falling into Gaspé basin on the east. Later on, Mr. Bell surveyed the York and Dartmouth rivers. In 1883, Mr. Low crossed the peninsula *via* the southern branch of the Ste. Anne river and the western branch of the Little Cascapedia river, making a portage of 3 miles to cross the line of the water-shed. In the same year Mr. Ells studied the country around the sources of the Cascapedia and Bonaventure rivers on the south and the Ste. Anne-des-Monts and Magdalen rivers on the north, and the Shickshock mountains on the east, and published a series of maps of that region. The results of all these explorations were published in the reports of the Geological Survey of Canada.

Between 1907 and 1911, Dr. J. M. Clarke published some works on the rocks in the neigbourhood of Percé and Gaspé Basin. In 1910, the author of the present report was directed by the Quebec Mines Branch to make a geological investigation along the York and Dartmouth rivers and St. Anne-des-Monts[1]. The guide-books of the International Geological Congress in 1913, contain a detailed description by Dr. Clarke of the principal points on the coast visited by the congress. In the annual reports on the mining operations of the Province of Quebec for the years 1915 and 1916, some notes are given on the development of the Fairview mine, now operated by the Federal Zinc and Lead Company.

With the exception of the explorations just mentioned, nothing positive is known regarding the various rivers and streams and especially those falling into the Baie des Chaleurs and Gulf of St. Lawrence. Rough sketches of some of the more important branches may be found on the plans made by surveyors who went through the region seeking for timber limits; but, as there is no connection between them, they are far from satisfactory.

Water Supply

Owing to the torrential character of the Berry mountain and Brandy creeks, their flow varies greatly from one season to another. The slopes of these creeks and of their tributaries are very steep and, consequently, the slightest atmospheric precipitation at once increases their flow, while a short rainless spell suffices to dry them up. The Brandy creek itself went quite dry at the beginning of August 1917, at the level of the northern line of Lemieux township. It may, however, happen that there is an underground channel at that spot. The Great Cascapedia river itself is also subject to many fluctuations from one season to another, but its flow is good throughout the year.

Lake St. Anne (plate I), about 6 miles east of the Federal Zinc and Lead Company's mine, is the most important sheet of water in the region. It is 5 miles long with an average width of a mile, and its outlet is the river of the same name which flows towards the river St. Lawrence. About 12 miles below the lake, the St. Anne river, owing to the serpentine mass of Mount Albert, only

[1]A. Mailhiot:—Geological exploration in the Gaspé district, Report on the Mining Operations of the Province of Quebec for the year 1910, p. 86.

partially cut away by fluvial erosion, drops vertically in falls 60 feet high. Mr. Low says that the St. Anne falls are about half a mile above the forks and are about 60 feet high[1]; the river here has forced its way through the flank of Mount Albert below the falls and runs through a fine and deep gorge, a quarter of a mile long, whose perpendicular walls rise more than 200 feet above the river.

The lake might perhaps serve as storage basin for regulating the river's flow and from the falls could then be developed sufficient electric power for extensive works. But the flow from the lake and the height to which its water level may be raised will have to be calculated. The water-shed between the St. Anne and Little Cascapedia rivers is a short distance to the south of the lake and, we think, but slightly above its level.

Forests

The region is well timbered except on the summit of the highest mountains, which are completely bare. In the district we are dealing with, the only bare peak is that of the mountain west of lake St. Anne. Some crests of the Shickshock axis, such as Mount Albert and Table mountain, are also bare.

The most valuable trees towards the head of the Great Cascapedia river and especially in Lemieux township are as follows, in the order of their abundance; black spruce (*Picea nigra*), balsam fir (*Abies subalpina*), and white or paper birch (*Betula papyracea*). Towards the lower part of the river, starting from the forks, the following are found in addition to the above: cedar (*Thuya occidentalis*); maple (*Acer saccharinum*) and black birch (*Betula lutea*).

As a rule the timber is not of great diameter especially on the more or less steep slopes of the valleys. The best is usually found in the flats along the streams and in the depressions between the hills.

So far, no lumbering operations have been carried on in the region under consideration and none have gone beyond the forks of the river on the Salmon branch; it contains, nevertheless, excellent pulpwood, timber for mine props, fuel for the boilers, etc.

The layer of light soil covering the solid rock is sometimes very thin on the heights and the trees offer but little resistance to the wind. The region is consequently full of windfalls making it almost impossible to get through it.

[1]Low, A. P., report of the Geological Survey, 1883, Report F.

Mining Conditions

The Federal Zinc and Lead Company, the only one that has done any mining work of any importance in the region, has so far not shipped any ore, although it has been in continuous operation since 1915.

Lack of transportation facilities from the mine to the railway is the sole reason that prevented the company from shipping ore. At present (February 1918) there are two carloads of hand-picked ore, ready to be sent to the smelter and not less than 8,000 tons of ore ready to be treated by concentration. The company is likewise waiting until a good road is made to erect a concentration plant.

There is an almost complete dearth of local labour for mining in this part of the country where the inhabitants are accustomed to farm work, cod-fishing or lumbering. The miners employed in getting out the ore, as well as the machinists and blacksmiths come from Nova Scotia mining centres. Nevertheless, the Federal Company has undertaken to train local labour by endeavouring to give the men a taste for and skill in mining and it hopes soon to be able to do without skilled workmen from outside the district.

Provisions and supplies required for operations cost very dear delivered at the mine owing to the excessive cost of transportation from the railway station to the mine over a bad road. Supplies are generally sent in during the winter when transportation is cheaper.

Topography

The most important topographical feature of the district is the long valley of the Great Cascapedia river, which stream runs approximately north and south (magnetic), takes its rise in the heart of the peninsula on the western slope of the Shickshock mountains, flows in a very deep bed it has eroded for itself in the mountains plateau of the interior, and falls into the Baie des Chaleurs at Cascapedia. About 40 miles from its mouth, it divides into two branches; one flowing from the Shickshocks, called the Salmon branch, and the other flowing from the northwest where it takes its rise in a lake, hence its name the Lake branch. Its flow is very rapid its grade being about 25 feet per mile. Its tributaries are likewise very rapid, their slope is generally greater and they are real mount-

Plate I.—Lake Ste. Anne, taken from the mountain west of the lake.

Plate II.—Mount Albert and Table mountain, from mountain west of Lake Ste. Anne.

ain torrents. Among the latter, are two which interest us more particularly because they cross the projected township of Lemieux; these are the Berry mountain and Brandy creeks, tributaries on the left bank of the Great Cascapedia river. The first takes its rise about 2 miles southwest of lake St. Anne on the line of the water-shed between the St. Anne and Great Cascapedia rivers, and falls into the latter 3 miles below the forks.

The second takes its rise at the foot of Mount Albert on the southern slope and falls into the Great Cascapedia river about a mile and a half above the forks. These two creeks run nearly parallelly to one another in a southwesterly direction. Other small streams fall into them and increase their flow. The valleys of these streams are always narrow and their sides are steep. They thus cut the mountain plateau into chains of hills by scooping out their beds in the strips of soft sedimentary rocks and going around the masses of igneous rocks which are harder and more resistant to stream erosion.

At a slight distance from the Great Cascapedia river, a chain of high hills, called the Great Berry mountains crosses the valley of this river. To the north of the chain, a strip of comparatively level land stretches for 8 or 10 miles forming a large inland plateau very well defined on a distance of several miles, both east and west, and probably extending from the vicinity of lake Matapedia to Gaspé basin. This plateau may measure from 1200 to 1500 square miles and a considerable portion is at an elevation of from 500 to 800 feet. In the vicinity of the falls on the river, at a distance of 30 miles from its mouth, the landscape becomes particularly wild, as the peaks of the Little and Great Berry mountains are from 1500 to 2000 feet in height. The precipitous and rugged landscape continues as far as the Shickshock mountains.

From the top of some peaks in this region, one has a panoramic view of the Shickshocks surpassing in grandeur anything that can be seen elsewhere in the eastern part of Canada. Thus, from the summit of the granitic mountain to the west of lake St. Anne, which is 2600 feet above sea-level, one can see, on the west, the immense mass of the La Grange mountain rising in a double peak to a height of 3400 feet; further on, the Conical mountain with an altitude of 3000 feet, both mountains marking the northern boundary of the inland plateau; then, further north, the rugged crest of Mount Albert (plate II) whose summit, with an altitude of 3700 feet, is the

highest; further, to the east, the transverse chain of Table mountain (plate II) whose peaks are not less than 4000 feet, seems to advance at a right angle to the alignment of all the others, while from the apparently level plain at one's feet, arise several conical masses whose outlines indicate a probably igneous origin.

West of the Great Cascapedia river, the country becomes much less rugged. The region adjoining the lake branch is comparatively low for the most part and broken only by some scattered crests and eminences. The most striking of these is the western extension of the Berry mountains chain (plate III).

General Geology

General outline.

The Gaspé peninsula forms part of that geological province which American geologists, Schuchert[1] in particular, call "Acadia" and which comprises the entire area now occupied by the Appalachians from the gulf of Mexico to Newfoundland and Labrador; from the river St. Lawrence, the great lakes and the Mississippi on the one side, and the shores of the Atlantic ocean on the other. This peninsula constitutes the northern extremity of the great system of the Appalachian folds. As part of the Appalachian system, the Gaspé peninsula consists almost exclusively of paleozoic rocks. The Notre Dame or Shickshock mountains, forming the elevated plateau of the peninsula's interior (altitude 3000 to 4200 feet) occupy the northern portion and contain patches of mica schists, jaspilites and epidotic gneiss, which evidently constitute the basement of the cambrian schists, but it has never been established that these rocks are precambrian. Many masses of peridotite, serpentine and granite are found there. During the paleozoic period, this part of the earth's crust was subjected to local and irregular movements; it was crumpled at various times and shoved to the northwest against the Laurentian plateau at the period of the great movements which gave rise to the Appalachians. These overthrusts are frequently masked by a mantle of more recent deposits.

The Gaspé peninsula seems to have escaped the eroding action of the great continental glaciers. Glacial deposits and striæ are scattered and correspond only to the flow from local glaciers starting from the mountains in the interior.

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[1]Schuchbert, Charles, Text Book of Geology 1915, p. 636.

"According to Chalmers, the striæ and direction in which boulders and till have been transported indicate that the ice which mantled the country around Baie des Chaleurs during the glacial period moved radially into it from the northwest and south, forming a local estuarine glacier. In the latter stages the ice seems still to have pushed down from the high interior of Gaspé through such valleys as the Cascapedia and Nouvelle after it had disappeared as a sheet from the coast. The kames of the north shore of the bay which lie unmodified on ground within the 200-foot limit, seem to demand this"[1].

During and after the Appalachian deformation, the devonian shales were intruded by the plutonic rocks now occupying the greater part of the region studied in this report. We have subdivided the latter into three principal groups from north to south; the granite porphyries, the syenites and the basic igneous rocks. As we did not find them in contact with one another, we are unable to state definitely their order of succession. Judging by their attitude, we have reason to believe that these igneous masses forced their way through the sedimentary rocks in an order of decreasing basicity, namely: first of all, invasion and flow of the basic igneous rocks; then intrusion in a batholithic form of coarse-grained syenites, and the volcanic activity, ended with the flow of granite porphyries, giving rise to the formation of veins of mineralized quartz intersecting the sedimentary schists.

Below is a provisional table of the formations:

Devonian

Veins of mineralized dolomitic quartz
Granitep-orphyries
Syenites
Basic igneous rocks
Sedimentary rocks.

Age of the Rocks.—The sedimentary rocks in the region under consideration have been classified by Ells (2) in 1883. as belonging to the Devonian period. He says: "The rocks seen in the Miner's Brook consist of grey sandstones and shales holding abundance of

[1]Goldthwait, J. W., Guide Book of the International Geological Congress, page 119.

[2]R. W. Ells, Report on the Geology of the Gaspé peninsula, P.Q. Annual Report of the Geological Survey of Canada, 1883, p. 21E.

psyliophyton stems and other fossils peculiar to the horizon of the Oriskany and Hamilton formations.

"As we approach the forks (of the Great Cascapedia river) the beds gradually become reddish and resemble in character the lower carboniferous of the Baie des Chaleurs. These extend down the lake stream to a short distance below the forks of the Salmon branch. On this stream, they extend northward for six miles in a direct line where they again gradually pass into the typical grey sandstones and shales of the Gaspé sandstone series, and further north rest unconformably upon silurian strata. The red beds lie in a nearly horizontal position or dip southerly at angles of 5° to 7°.

"The width of the devonian basin on the Woodman's Brook and on the Salmon branch is 21 miles, of which the upper 10 constitute the great inland valley described in our introductory remarks. The country along the lower 11 miles is exceedingly rugged, including the ranges of the Big and Little Berry mountains which form a chain of lofty hills extending for many miles in either direction."

For our part, we must say that the shales, constituting the only sedimentary rocks of the region and forming a wide strip running northeast and southwest across the claims, are entirely devoid of fossils. There is a superb section of these shales along the Federal mine road from the point where the latter leaves the Berry Mountain Creek to go around the hill, and it was impossible to find traces of organisms along the whole length of that section. The only organic remains found in the region were among the blocks in the Federal mine dump and consisted of two stems of crinoids.

Since our visit, we have learned from the owners of the Federal mine that their workings in the northern part of the tunnel have cut through two strips of limestone whose direction lies generally across the tunnel. For the present we provisionally place the shales of Lemieux township in the devonian period as classified by Ells, but we call the reader's attention to the fact that paleontological evidence has not yet been given and it is to be noted that the lithological analogy existing between these schists interbedded with limestone and the silurian section of Black Cape, is more perfect than the known devonian sections on the Gaspesian coast.

As to the age of the intrusion of igneous rocks, it clearly seems to be devonian. As we have stated above these intrusions date from the period of volcanic activity that prevailed during the close of the

devonian period at the time of the formation of the range of Shickshock mountains which are the prolongation and form part of the Appalachian system.

Sedimentary Rocks.—The sedimentary rocks of the region consist of slaty schists occupying a strip about a mile wide with a northeast-southwest strike, bounded on the north by granite porphyry and on the south by the basaltic groups. These rocks constitute the oldest geological formation within the limits of the mining camp and they are cut by all the igneous masses and by metalliferous veins of galena and blende. These sediments are, therefore, the remnants of an old formation (probably the devonian) when the eastern part of Canada was under the sea and formed an immense basin wherein great quantities of detritic materials were accumulated or thick banks of limestone were formed at times when the waters were clearer. These deposits now constitute the thick paleozoic strata forming the framework of the majestic Shickshock range, so well represented on the coast of Gaspesia, at Percé and Black Cape in particular. The end of that devonian period was also characterized by extensive volcanic phenomena causing lava flows, intrusive sheets, and the upward movement of batholithic masses.

Devonian limestones are practically non-existant in the region under consideration; they were met with only in the Federal Zinc and Lead Company's tunnel, but the beds of sedimentary schists are well represented and, moreover, there are very abundant vestiges of volcanic action. Thus the devonian formations represent a portion of the earth's crust which was the scene of igneous activity. The shales are at times soft, dense rocks, slightly carbonaceous and black in colour. They pass laterally into quartzitic banded forms of a lighter colour, whilst elsewhere they become calcareous. As a rule, however, the shales of this region are very hard, very siliceous in appearance and of a dark greenish colour changing to dark brown along the jointage planes or near the surface. This oxidation is probably due to the decomposition of the pyrite finely disseminated in the shales.

Although the beds of shales have nearly everywhere a dip towards the south, we recorded several local variations, often abrupt, in the dip and strike. The general strike noticed usually varies from north 70° to 80° east, and the dip between 45° and 70° to the south.

The shales have also been subjected to displacement movements

along fault planes. Some of these planes are visible in the Federal Zinc and Lead Company's tunnel.

Geographical Distribution of Basic Igneous Rocks.

These rocks cover a large area in the southern part of this region; they form a transverse strip from the vicinity of Brandy creek, at least, on the west, to beyond the Beidelman claim, Block N. on the east. The nearest point to the north where we found them is about 13 chains south of stake No. 4 of the Lyall claim, Block K, where they form a precipitous cliff about 100 feet high, and on the top of a hill west of the J. B. Caine claim, Block G. They are next found as outcrops along the portage road of the mine to within a short distance from the mine hill. They outcrop also in the southwest corner of the Gosselin-Leblanc claim, Block L, in various places on the Buyer's claim, Block M., and in the southern half of the Beidelman claim, Block N. The places enumerated above are along a sinuous line running perceptibly east and west and marking the approximate contact of these basic rocks with the sedimentary schists. Good-sized outcroppings of these rocks are also met with along Berry mountain creek, about 2 miles south of the mine, as well as south of the Lyall claim, Block K. West of the road outside the claims, these rocks are found only in proximity to the road to about 3 miles from the mine. Further towards the interior, outcrops are completely lacking. The same basic rocks are again found at the foot of the bare mountain west of lake St. Ann.

Petrography of the Basic Rocks.

These rocks present to the naked eye great varieties in texture and in the size of the grains; from very fine grained compact rock to granular rock with large feldspar phenocrysts. Some varieties are vesicular and contain an infinite number of small globules of calcite surrounded by a green coating. In one instance, a small cube of galena was found in the centre of one of these globules. In some specimens the globules constitute nearly one-half the rocks volume. This green coating is also very frequently disseminated in the more compact rocks.

Under the microscope these rocks are seen to vary in mineralogical composition and texture from basalt to microgabbro. The fine grained specimens consist of aggregates of plagioclase and augite partially or totally transformed into hornblende. The ground mass

in the vesicular varieties consists of the same elements as those of the compact rock, that is to say of aggregates of plagioclase and augite and the vesicules are filled with globules of calcite surrounded by a green coating consisting of very fine needles of actinolite. Some varieties, with medium-sized, uniform grains, of an ophitic texture, of feldspar and augite, are real diabases while others have large phenocrysts of plagioclase in an aphanitic ground mass of uralitized pyroxene and soda-lime feldspar and may be classified as micro-gabbros.

All these varieties form part of the same igneous mass. The basalts pass laterally and in height into more granular rocks and the latter into porphyritic varieties, the whole forming an exceedingly complex mixture.

The rocks probably represent products of volcanic flows on the surface of the sedimentary rocks of the devonian period.

Syenites.—Geographical Distribution.

We found these rocks in four principal outcrops in this region. The most extensive mass is situated southeast of the shaft of the Federal Zinc and Lead Company's mine, where there are outcrops on each side of the Berry mountain creek, at the corner of the three Caine, Miller and Beidelman claims, Blocks H, J and N. This massif is about 75 acres. Another mass appears in the middle of the schists in the valley of the small brook falling into the Brandy creek along which the old portage road had been made. Two other small masses were found in the northwest corner of the J. B. Caine claim, Block F and the other on the western line of the Maher claim, Block C.

Syenites.—Petrography.

The prevalent colour of these rocks and of those associated with them is dark gray, sometimes tinted red by the orthoclase feldspar. With the increase in basicity, the colour changes and becomes uniform and darker, or dappled gray owing to the presence of small basic inclusions. The red varieties are found in the first two masses described above. The texture of the syenitic rocks is holocrystalline and very uniform in the outcrops examined. Their structure is massive and intergrown everywhere. Under the microscope, a slight crushing is sometimes seen, but not sufficient to have produced crushing planes. The jointage planes are very numerous and cut up the rocks into angular blocks.

The syenitic rocks present differences of weathering according to structure. When the structure is massive, as in the case of red syenites, the alteration is far advanced to a great depth. It is then impossible to obtain a fresh specimen in the surface rocks. Under the microscope the feldspars are always more or less cloudy, transformed into white mica and kaolin and sometimes unrecognizable, while the ferro-magnesian elements are partially or entirely transformed into chlorite, epidote, zoisite and other products of decomposition. The rocks whose structure is interlocked are much more resistant to weathering, and their minerals are less decomposed.

The mineralogical composition of the syenitic rocks usually consists in orthoclase feldspar and hornblende as essential constituents, with magnetite and apatite as accessory minerals.

Some crystals of plagioclase feldspar are also met with as well as isolated quartz crystals, but never in quantities of any consequence.

Granite-Porphyries.—Geographical Distribution.

These rocks cover a large area in the northern part of the claims. Their contact with the sedimentary rocks follows a transverse east-west direction. They are found in isolated patches on the Caine claim, Block H, and on the Beidelman claim Block N., as well as on top of the mountain west of lake St. Anne.

Granite Porphyries.—Petrography.

In hand specimens, these porphyritic rocks are always of a light colour, varying between yellowish, reddish and greenish white. They are sometimes intersected by dykelets of white quartz, sometimes by stringers of reddish feldspar. Phenocrysts of quartz and feldspar are discerned in a matrix of uniform, very fine-grained texture. In a single place, near the northern line of the Caine claim, Block N., in the cleared area around the Federal Zinc and Lead Company's mine, we found a coarser variety of these porphyries. The phenocrysts of orthoclase are as much as an inch in length and are more numerous than the quartz ones which are not so big. The feldspar was cut by a quartz vein 2 inches wide containing some small grains of galena and zinc-blende.

As seen under the microscope, the fine grained matrix of the rock consists solely of aggregates of quartz and orthoclase feldspar and we have classified these rocks as granite-phorphyries. The origin of the metalliferous veins of the district is probably connected with

Plate III.—Shaft house and boiler plant of the Federal Zinc and Lead Co.

Plate IV.—Breccia in crushed mineralized zone in mine of Federal Zinc and Lead Co.

their intrusion. Their overflow probably occurred subsequently to the settling of the other eruptive rocks of the region.

All these eruptive rocks constitute a series of decreasing basicity from the basalts and diabases containing isolated quartz grains to the granite porphyry with quartz as one of the rock's essential elements. This fact leads us to suppose that all these rocks originate from the same deep-seated magma. The quartz veins would be the last stage of the magma's igneous activity.

Economic Geology.

General Features of the Deposits:

Geographic Distribution.—

The deposits of blende and galena, so far discovered in this region, consist of some veins outcropping on the J. B. Caine, Gilker & Bois claims, Blocks A, D. and E. mined by the Federal Zinc and Lead Company and on the Gosselin-LeBlanc claim, Block L, the property of the North America Mining Company. The greater number of these veins runs directly northeast-southwest. We found some whose strike was across that of the former. They intersect all the schists with dips varying between 70° and 90°. Clearing a certain area of ground around the shaft of the Federal Mine revealed some of these veins; others outcrop along the mine road where it runs around the hill. An outcrop of a vein was found along the old portage road from Brandy Creek to south of the Allen claim.

Small veins of chalcopyrite were found on the small Brown claim, Block 1761-A; on the Gosselin-LeBlanc claim, Block 1182-A, and on the Allen claim, Block B.

Metalliferous Veins and Workings.—

The mineralized veins contain zinc-blende, galena and some scattered grains of chalcopyrite and pyrite. The gangue forming the filling of the fissures consists of white and amethystine quartz and dolomite. The walls sometimes, as in the Federal mine and the McKinley tunnel, are formed by a breccia (plate IV) whose angular elements have been more or less altered and transformed into green chalcedony by the mineralizing solutions; the same applies to the country rock.

The filling is in distinct parallel veins or in intersecting veins, and, in other places, the mineralization lies in the spaces between the fragments of the breccia of the crushed zone.

Portions of veins, very well banded are found in which the streaks follow one another in regular order and where the ores are in a definite order from the walls to the center of the vein, but the banding is oftener very irregular or completely lacking and the veins are formed of large intergrown crystals which seem to have crystallized simultaneously. In the veins with a well-defined banding, there are frequently fine crystalline faces turned towards the centre of the vein; this phenomenon occurs oftener in the amethystine quartz whose elongated crystals are developed normally to the walls and have the appearance of comblike structure. Sometimes also the extremities of the crystals point towards the interior of a cavity and form druses lined with fine crystals. The sulphides, both galena and zinc blende, are irregularly disseminated in the veins or form concentrated pockets.

During the present investigation, we were unable to determine the nature of these local concentrations owing to the small amount of underground work done in the region.

We give below a table of the analyses furnished by the Federal Zinc and Lead Company. These analyses were made in the laboratory of the Canadian Inspection and Testing Laboratories, Limited, of Montreal.

	Zinc (Metallic)	Lead
	%	%
19th August, 1915.....	23.10	14.44
	18.05	2.09
	14.18	35.99
	12.10	3.54
	40.28	11.53
	1.94	0.86
	12.15	78.18
	8.40	30.60
	19.17	8.32
	31.02	2.36
	24.08	10.32
	9.72	3.54
24th January, 1916.....	22.10	2.67
	6.78	17.60
	36.89	1.44
	6.15	1.86
	52.91	2.56

	Zinc (Metallic)	Lead
	%	%
24tth January, 1916.....	7.60	7.89
	25.60	5.86
	8.73	2.61
	5.12	2.34
	13.82	1.07
	5.17	0.69
	28.70	1.92
	42.40	4.10
17th August, 1916.....	21.43	5.77
20th December, 1916.....	12.80	6.00
17th August 1917.....	12.20	4.20
	12.14	1.08
	8.42	3.16
	7.45	12.90
	16.15	5.40
	4.80	11.24
	12.61	1.09
	9.11	2.04
	16.21	2.12
	21.03	11.06
	12.16	2.09
	7.42	3.23

The following table gives the results of analyses made in the laboratory of the Provincial Government on the 10th September, 1917.

	1	2	3	4	5
	%	%	%	%	%
Lead.....	4.44	0.55	0.32	1.04	0.82
Zinc.....	6.18	3.97	1.53	4.62	2.74
Gold, ozs. per ton.....	0.04	0.05	0.08	0.02	0.09
Value of gold.....	$0.80	$1.00	$1.60	$0.40	$1.80
Silver.....	none	none	none	none	none

(1 and 2.)—Samples from the dump at the shaft of the Federal Zinc and Lead Company's mine.

(3 and 4).—Samples from the dump at the adit of the Federal Zinc and Lead Company's mine.

(5).—Samples taken at a depth of 30 feet in the shaft of the North America Mining Company, Gosselin-Leblanc claim, Block L. These analyses represent the results of the sampling, on the dump, of the particles of disseminated ore. The rich concentrated ore had been removed and hand cobbed.

The most developed claim of the region is that of J. B. Caine, Block H. It is a portion of the claim staked out by Mr. James McKinley in 1910. It now belongs to the Federal Zinc and Lead Company. The work done on this claim consists of an inclined shaft of 115 feet deep sunk on the deposit at an angle of 70° towards the West, and of a drift starting from the foot of the shaft, following the direction of the vein, about N. 40°E. for a length of 1060 feet and opening on the side of the hill. The vein is 12 feet wide. The other work done on the claim consists of prospecting trenches for uncovering the metalliferous veins outcropping at the surface. Several veins crop out in the cleared area around the mine shaft. One of these veins runs in an approximately north and south direction, passes under the company's kitchens and successive outcroppings are then found over a length of about 2,000 feet, as far as the Gilker claim on the north. Another vein outcrops about 50 feet north of the boiler-house, its direction is N15°W. Other outcrops are visible to the south of the shaft in the cleared area. One of these veins runs in a N15°E direction with a dip of 75° east. There is another outcropping on the hillside at the place called "McKinley's Tunnel." The mineralized portion is about 60 feet wide, (Plate V), and the veins have a north to south strike with a vertical dip. Other veins outcrop on the mine road one at the foot of the hill and the other half-way up.

On the Gilker claim, Block D, a shaft, about 20 feet deep and 10 x 10 feet, has been sunk upon a surface outcrop in the line of the vein worked by means of an adit on the J. B. Caine claim, Block H. Other veins of this block crop out on this claim.

On the Bois claim, Block E., 6 small excavations have been made varying from a few feet to 20 feet in depth, in the iron capping of an outcrop.

These excavations are about 100 feet from the western line of the Bois claim, 30 chains south of stake No. 4 of that claim. There are other outcrops of veins on the hillside near the south-western corner of this claim.

Three excavations have been made on the Gosselin-Leblanc claim, Block L. belonging to the North America Mining Company.

One is near the northern line of the claim, about 700 feet to the east of stake No. 4. The vein is 4½ ft. wide at a depth of 30 feet. Its trend is N. 15° E. and its dip 80° to the west. Another superficial excavation, 15 feet deep, 10′ x 10′ is situated in the interior of the claim 320 feet southwest of the foregoing one. Two veins have been uncovered with a N 25° E. trend and a vertical dip. A third excavation, 4 feet deep, 8′ x 10′ is situated about 350 feet to the southwest of stake No. 1 of Block L. Here two veins have been uncovered with strikes N. 65° W. and N. 47° W. respectively and an almost vertical dip. Another vein outcrops on the northern line of this claim 8 chains to the west of stake No. 1.

On the Gosselin-Leblanc claim, Block 1182-S. the property of North America Mining Company, two strippings have been made: one is 5 feet deep, 8′ x 8′, and the other 3 feet deep, 5′ x 6′. These excavations are about 4 chains northwest of stake No. 2 of this claim. The veins contain hematite with traces of copper.

On the small Bois claim, Block 1261 A, owned by the North America Mining Company, an excavation has been made 5 feet deep 10′ x 10′ on the southern line of the claim about halfway between stakes No. 2 and No. 3. The crushed veins, in the superficial portion that has been uncovered, contain traces of copper in white and amethystine quartz.

On the Clapperton claim, Block 1230, the property of the North American Mining Company, is an excavation 4 feet deep, 10′ x 10′, 100 feet from stake No. 4 of the little Bois claim near its northern line. This excavation in the schists had not brought to light any vein at the time of our visit.

Ores.

Galena (PbS).—

The galena in the veins of the projected township of Lemieux occurs in the shape of grains of all dimensions from small flakes, very thinly disseminated among the zinc-blende and the gangue, to cubes measuring 2 inches (plate VI). Sometimes it forms, with the blende, solid masses weighing over 1000 pounds. In the upper part of the lode the galena, less soluble than the blende, occurs alone amidst the chambered quartz, coated with reddish oxide of iron and white smithsonite. The gangue of the metalliferous veins, formed of quartz and dolomite, makes the ore very easy to concentrate by the ordinary mechanical processes.

It is generally admitted, in spite of rather numerous exceptions that the granular galenas, with small facets are more argentiferous than those coarsely crystalline. The galenas of the projected township of Lemieux are usually coarsely grained and follow the general rule. A great many analyses of ore made by the Federal Zinc and Lead Company revealed traces of silver only. It is otherwise with gold. All the analyses give gold and as much as $2.00 to the ton. An analysis of the samples from the Gosselin-Leblanc claim, Block L., gave $1.80 worth of gold to the ton.

In the veins opened by the mining workings or by prospecting trenches, galena is always less abundant than the zinc-blende, as may be seen by the table of analyses given above, except perhaps when the ore forms solid masses in which galena seems to be in greater quantities than blende.

Zinc Blende (ZnS).—

Blende is the zinc ore of primary origin which is the most common and abundant in nature; and, in most deposits of sulphide ores, it is the only important source of zinc. This mineral is one of the principal constituents of the metalliferous veins of Lemieux township, where it is usually found in larger quantities than galena. The blende of the deposits in Lemieux township is very pure and almost free from iron; its colour varies between waxy yellow and reddish brown. In the upper portion of the veins, near the surface, the blende has been partly or entirely dissolved by the meteoric waters and replaced by smithsonite as a whitish coating on the walls of the dissolution cavities. Like the galena it is coarsely crystallized and presents wide cleavage facets.

Smithsonite (CO^3Zn).—

Smithsonite appears as a whitish coating inside the dissolution cavities in the gangue. It is essentially a secondary mineral; it is found only among the ores of the alteration zone, and its existence is closely connected with the vicinity of the superficial waters charged with oxygen and carbonic acid. In all the outcroppings in Lemieux township that we examined, we observed the presence of this white coating of smithsonite. The depth at which this mineral is found, varies and depends upon the fissured nature of the rocks. In certain parts of the adit of the Federal mine it is not found, while elsewhere, especially in the vicinity of the fissures or near the tunnel entrance, it is abundant. In the shaft of the North American

Plate V.—Location of McKinley tunnel, showing width of mineralized zone.

Plate VI.—Ore from mine of Federal Zinc and Lead Co., showing coarse cubical crystals of galena.

Company on the Gosselin-Leblanc claim, Block L, which was 30 feet deep at the date of our visit, the smithsonite shows down to the bottom of the shaft. The meteoric waters probably followed the hanging wall of the vein and deposited carbonate of zinc down to that depth.

Malachite; ($CuOCO^2$, $CuOH^2O$).—

The green carbonate of copper is the ordinary product of the alteration of cupriferous ores. It was found in certain quartz veins containing chalcopyrite on the small Bois claim, Block, 1261-A. Also in a vein of chalcopyrite in Brandy creek, Block B.

Chalcopyrite ($CuFeS^2$).—

This ore is rather rare in the region we studied. It is found only exceptionally in the state of isolated patches in veins of mineralized quartz. It seems to have been formed subsequently to the zinciferous and plumbiferous mineralization. This ore is practically absent from the Federal mine tunnel on the J. B. Caine claim, Block H. Further to the north, in shaft No. 3 on the large Bois claim, Block E., it is more abundant. Further north still, on the little Bois claim, Block E, are quartz veins containing a little chalcopyrite only. It seems that this mineral becomes more abundant as one approaches the mass of granite porphyry to the north of these claims. On the Brandy creek, Block B., there is a brecciated zone, about ten feet wide, in which are found stringers and impregnations of chalcopyrite associated with pyrite.

Hematite (Fe^2O^3).—

Hematite is found in some veins of the Gosselin-Leblanc claim, 1261-A, where the gangue is white quartz.

Minerals of the gangue

Quartz Si^2O.—

Quartz constitutes the greater portion of the gangue of the metalliferous veins of the region. It is often associated with dolomite. It is present in two varieties, white quartz and amethystine quartz. The white or vitreous quartz is usually finely crystallized while the amethystine quartz has large crystals normally developed on the walls of the vein or sides of the original cavity previous to the filling. The banding is sometimes very clear, the centre of the vein

being occupied by the amethystine quartz, and the sides by white quartz. The amethystine quartz was the last to form in the filling of the vein. It contains galena and zinc blende only exceptionally. In thin sections it is observed that the quartz is prior to the dolomite, because the latter sometimes occurs in the shape of fine rhombohedric crystals covering the interior of the lodes filled with quartz.

Dolomite ($Ca\ Mg\ C^2O^6$).

Dolomite constitutes with quartz the filling of the veins containing blende and galena. We did not find it in the veins containing copper ores exclusively. It alters at the surface assuming a yellowish tinge and in the iron hat it has at times been removed by dissolution. It came after the quartz in the phenomenon of the filling of the lodes.

Oxidation.—The upper part of the lodes was completely altered into products of oxidation by the infiltration of surface waters. The outcrop of the metalliferous veins or iron capping forms a brownish red mass of decomposed rock containing chambered residual quartz and limonite from which the sulphides have been removed by leaching. The zinc blende, more soluble than the galena, was the first to be removed, and sometimes the two sulphides disappeared. The original existence is deduced from the white smithsonite. This secondary alteration is found in the breccia in the foot-wall of the Federal mine tunnel at a depth of 115 feet, the greatest depth reached in the region.

Origin of the deposits

Judging by the attitude of the deposits and the mineralogical association of the ores and gangue, we think we may conclude that the metallic sulphides zinc-blende, galena and chalcopyrite were deposited by ascending heated solutions containing metallic substances derived from igneous emanations. The appearance of the minerals in the shape of fillings of fissures, the trend of the veins, often very well banded and sometimes presenting combed and drusy structures, clearly show that the deposits are of aqueous origin. The absence of the minerals characterizing the zones of metamorphic contact, the deep zones and the superficial zones, lead us to believe that the sulphides were deposited at intermediary depths, that is to say, according to Lindgren ([1]), between 4000 and 12000 feet below the original surface of the soil at temperatures of between 150° and 300° centigrade and under pressures of 140 to 400 atmospheres.

[1]Lindgren, Waldemar, Mineral Deposits, pp. 513-516.

At the time of the devonian orogenic upheaval which gave rise to the Shickshock range, the sedimentary rocks of the region were fissured, crushed and considerably displaced and altered. At the same time, the basic eruptive masses, the syenites and the granite porphyries, were successively forcing their way through the open fissures or following new fractures in all directions. The most important fissures from an economic standpoint are connected with the intrusion of masses of granite porphyry. The syenite masses were cooled under a thick cover of sedimentary strata which the subsequent erosion partially removed. It seems that a considerable period must have elapsed between the syenitic intrusion and the next eruption, and it is probable that erosion had removed a great part of the sediments covering the syenitic masses when the flow of granite-porphyries occurred.

The upward shove of the igneous mass, probably caused compression strains immediately before the intrusion of the granite-porphyries. Several fissures, due to crushing and breaks, were produced in the formations covering the batholith. The molten rock with its gases and precursory solutions penetrated into the fissures of the rocks of the hanging wall and occasioned the metamorphism of the schists and the formation of quartz veins.

The system of fissures resulting from the decrease of local tension and contraction strains in the rocks of the hanging wall and in the subjacent batholith itself offered channels for the circulation of the mineralizing solutions. Solutions caused and generated by the batholithic intrusion, ascended from great depths and deposited the elements they held in solution; lead, zinc, copper, in the shape of metallic sulphides in a quartz gangue. The first solutions, at a very high temperature and under very strong pressure were highly silicious and deposited quartz and dolomite in the fissures and sometimes attacked the walls. These solutions were soon followed by other metalliferous ores containing chiefly galena, zinc-blende and a little chalcopyrite. The forced ascension of these solutions caused a widening of the fissures in certain places by producing a crumbling of the walls. These debris were cemented with quartz and dolomite and constitute the breccia found in the hanging wall of the Federal mine and at the McKinley tunnel.

Depth of the deposits.

Not one of the deposits prospected or mined has been examined to a greater depth than 115 feet and the question of their continuation in depth is of great interest.

As the deposits are fillings of great fractures of the earth's crust, it would seem that they must go down to the base of the slaty sedimentary rocks. At the slight depth reached some veins show an increase in the volume of ore, while its character remains the same. There are outcroppings of ore not distant from each other between which are differences of level of several hundred feet and it is almost certain that the highest deposits go down in depth at least to the level of the lowest ones. Thus, the difference of level between the summit of the Federal mine shaft and that of the North America Mining Company on the Gosselin-Leblanc claim, Block L, is about 400 feet. Some veins on the J. B. Caine claim Block H, have been followed for distances of about 3000 feet and it is probable that they extend still further under the cover of superficial deposits. Then the natural inference is that these veins must go down to considerable depths, for it is generally admitted that the length of a fissure is proportionate to a certain extent to its depth.

Present and Future Conditions of the District

At present, two companies only are interested in the mining claims of the district, namely: the Federal Zinc and Lead Company and the North America Mining Company. The former has been mining for two years on the J. B. Caine, Gilker and Bois claims, Blocks H, D, and E. It has driven a tunnel about 1000 feet long and all the ore taken out is in piles ready for treatment with the concentrator. Lack of means of communication has so far delayed the construction of a concentration plant and the shipment of cobbed ore. Further on will be found some details regarding this company's plant and a description of the work done. The North America Mining Company, which owns several claims in this region, is as yet only in the early prospecting stage. The claims prospected by it are: the Gosselin-Leblanc, Block L, and the little Bois claim, Block 1261-A, as well as the Gosselin Leblanc claim situated to the north of the Gilker claim. The work has uncovered some veins of good ore but the depth reached is not sufficient to go beyond the oxidation zone.

There are certainly a great many veins hidden under the thick mantle of moss and vegetable debris covering the solid rock. We call prospectors' attention to the opportunity presented by the strip of sedimentary rocks in which the known deposits lie, especially

those bordering the masses of igneous rocks, in a northeast-southwest direction, extending both ways beyond the staked claims.

The whole of Gaspesia offers a vast field for prospecting. No systematic work of that kind has as yet been done and the rudiments of its geology are barely known.. For the moment the places offering themselves for prospecting are the slopes along the streams which often show fine natural sections of the rocks. The high mountains in the interior are also sometimes denuded and their steep sides present bare rocks which can be easily prospected. The layer of moss and vegetable debris is easy to remove and the solid rock is found immediately beneath it, because the rocks are not covered with thick glacial deposits as in the Laurentian plateau and elsewhere; the valley bottoms alone are covered with a thin layer of fluvial deposits. In a word, Gaspesia, with its many igneous peaks and batholithic and laccolithic masses, presents a vast field for prospecting in which chances of success are as great, if not greater, than in any other region of the Province of Quebec. The history of the projected township of Lemieux—which has in two years been transformed from a wilderness into an active and comparatively rich mining centre—may be repeated for other parts of the peninsula.

Description of the Workings

The Federal Zinc and Lead Company has had work done on Blocks H, D, and E.

On Block H a shaft 10 feet by 8 has been sunk to a depth of 115 feet. It is vertical for the first 45 feet at which depth it meets the vein; from that point it follows the vein for a distance of 70 feet with a dip of 70° to the west. (Since our visit the shaft has been straightened vertically). At the bottom of the shaft, drifts have been driven along the vein which has an average width of 12 feet. The one on the North side trends N 40° E. for a distance of 180 feet, then it turns almost due north for 150 feet. The drift on the north side trends S. 45° E. on a length of 180 feet; then it leaves the vein and runs S. 9° W, coming out on the slope of the hill facing Berry Mountain creek. From the spot where the southern drift leaves the vein, a cross-cut about 40 feet long has been run in a westerly direction perpendicularly to the vein which has been displaced towards the west by a fault plane. Thence the vein has been followed for a distance of 165 feet towards the south, forty-five feet

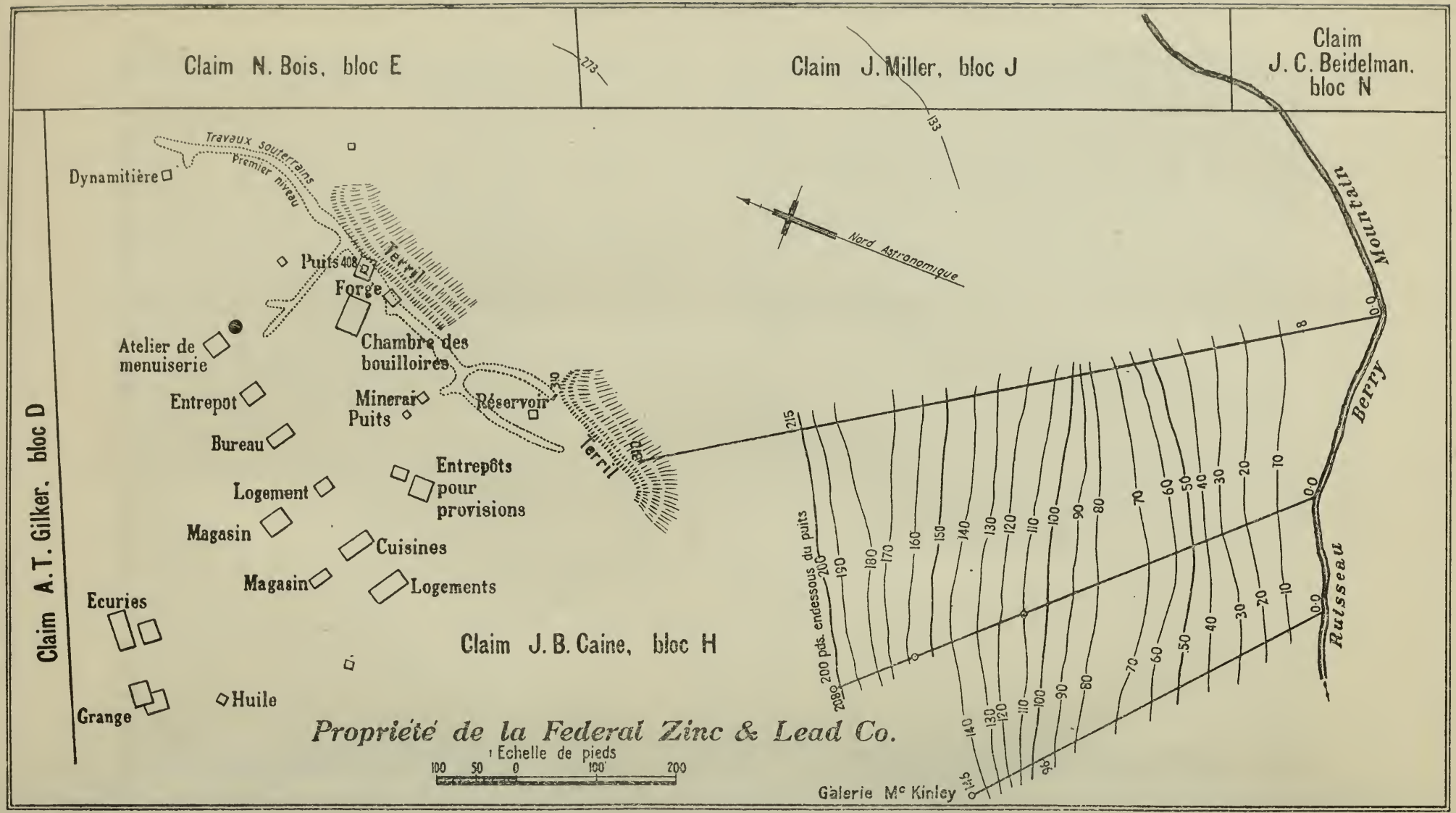

Fig. 4.—Plan of main camp of Federal Zinc and Lead Company.

to the north of the shaft a cross-cut has also been driven, running N. 56° W., which intersects a second vein, parallel to the main one, at a distance of 120 feet. This has been followed for 35 feet, and the cross-cut has also been extended 60 feet beyond the vein. The total length of the drifts and cross-cuts is 1060 feet.

The surface plant comprises a head frame and machine shed, a forge, repair shops, an office, a boarding house for 60 workmen, a powder-house and other minor dependencies such as stores, etc. The hoist has been put in for a depth of 1500 feet. Motive power is supplied by two Waterous boilers of 60 h.p. each. There is also an Ingersoll-Rand air compressor for five drills, pumps, tracks and ore trucks.

On Block D, a shaft 10 by 10 feet has been sunk to a depth of 22 feet. Work at this shaft was suspended at the date of our visit. There are also five surface trenches from 30 to 40 feet long and from 2 to 4 feet deep.

Prospecting pits have been made on Block E, and, in the summer of 1917 a 30 h.p. boiler and a Sampson hoist had been conveyed to the place for the purpose of commencing mining operations.

The North America Mining Company holding the mining rights on the Gosselin-Leblanc, Block L, Gosselin-Leblanc 1182-A, Bois 1261-A, Bois 1261-B and Clapperton claims, had some prospecting carried on there. On Block L, three excavations were made, two being superficial and to a depth of a few feet only, and a shaft 8 by 8 feet and 30 feet deep. This shaft is vertical and follows the vein to a depth of 20 feet, then it dips slightly towards the west with the vein. The ore is brought up with a tub and hand-winch. The work on the other claims consists of surface trenches or excavations of slight depth.

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