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REPORT ON MINING OPERATIONS IN THE PROVINCE OF QUEBEC DURING 1910

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PROVINCE OF QUEBEC
DEPARTMENT OF COLONIZATION,
MINES AND FISHERIES

MINES BRANCH

Honorable C. R. Devlin, Minister; S. Dufault, Deputy-Minister;
Theo. C. Denis, Superintendent of Mines.

REPORT

ON

MINING OPERATIONS

IN THE

PROVINCE OF QUEBEC.

DURING 1910

QUEBEC
PRINTED BY L.-V. FILTEAU,
Printer to His Most Excellent Majesty the King,

1911

AVERTISSEMENT

L'équipe de numérisation tient à informer le lecteur qu'il y a des erreurs dans la pagination. Le document est donc complet. Les pages blanches ont été enlevées.

Exhibit of Quebec Minerals at Toronto Exhibition, September 1910.

PROVINCE OF QUEBEC
DEPARTMENT OF COLONIZATION,
MINES AND FISHERIES

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DEPARTMENT OF COLONIZATION, MINES AND FISHERIES OF THE PROVINCE OF QUEBEC

To the Honorable C. R. Devlin, M. L. A.
Minister of Colonization, Mines and Fisheries
Quebec.

Sir,

I have the honor to transmit to you the Report of the Superintendent of Mines, on the Mining Operations in the Province of Quebec during the year ending December 31st 1910.

This report was preceded by a short statement published in February, giving figures of production of the Mineral Industry of the Province subject to revision. The revised figures as finally established, as well as considerable detail concerning the various branches of our Mining Industry are given in the present report, which therefore supersedes the Preliminary Statement.

I remain, Sir,

Your obedient servant,

S. DUFAULT,
Deputy Minister.

Quebec, June 1st 1911.

M. S. Dufault,
Deputy-Minister
Colonization, Mines and Fisheries,
Quebec.

Dear Sir :—

I have the honor to transmit, herewith, the annual report of the Mines Branch of the Province of Quebec for the year ending December 31st 1910.

The work of the Mines Branch naturally falls under two headings, viz :—the administration and the technical.

The administration comprises the carrying out of the provisions of the Mining Law, relating to Mining Lands, the issuing of Miner's Certificates, granting of Mining Licenses, sale of Mining Concessions, mining arbitration cases, collection of revenue etc. The report of this work is published in the general report of the Minister of Colonization, Mines and Fisheries and covers the fiscal year adopted in this province, which ends on June 30th.

Under technical work are comprised the compilation of the mineral statistics, the report on the mineral industry, the geological work, answers to enquiries concerning our mineral resources and mines, and the collection of data relating to these subjects, as well as the diffusion of knowledge thus acquired, to promote the development of our mineral deposits, to encourage and help prospecting and to draw the attention of capitalists to the possibilities of the mineral industry in the Province of Quebec. The report on this part of the work covers the calendar year.

PROVINCIAL CHEMICAL LABORATORY

Some ten years ago an arrangement was entered upon by the Mines Branch with Mr. Milton L. Hersey, the well known chemist of Montreal, appointing him provincial analyst.

The object of this arrangement was to enable prospectors and all persons interested in the mining industry to have analyses and examinations of mineral samples and specimens made in a reliable laboratory at very much reduced prices. The advantages of such a measure are obvious and that the public took advantage of it is proved by the fact that last

year some 1600 analyses were thus made by the provincial analyst.

In the last few years, the private interests of Dr Hersey have assumed such large proportions,. however, that he has now to devote practically all his time to them. In consequence, the Mines Branch has had to make new arrangements to ensure, after July 1911, the continuation of this chemical work which is quite a factor in helping the development of our mineral resources. It is a pleasure to record here our deep appreciation of Dr Hersey's work for the government during the ten years that he held the post of Provincial analyst. We are glad to say he has consented to be retained as consulting chemist to the government to act as such whenever any particular case will require expert consultation.

From the first of July 1911, the work of the provincial laboratory will be transfered to the Chemical Department of Polytechnic School of Laval University, Montreal where the modern and complete laboratories are now being enlarged and the equipment greatly improved. The work of chemical analyses of mineral samples and of identification of specimens will after that date, be done in the laboratories at the same rates which ruled in the provincial laboratory under Dr Hersey.

Samples and specimens will have to be addressed :— Provincial Laboratory, Polytechnic School Laval University, 228 St. Denis St. Montreal.

It is one of the legitimate functions of the Mines Branch to encourage by all available means the development of our workable ore deposits, and to guide prospecting by widely diffusing all knowledge obtained in the course of geological investigations and explorations made by the Department. It must be understood however, that the officers of the Mines Branch do not examine mining properties, mines or prospects for private parties from the standpoint of their commercial value or of their systematic exploitation. Such local examinations are only made in as much as they have a bearing on the investigation of the mineral resources or the geology of the district and no written report may be made by such officers to the private part-

ies. Such work really belongs to the consulting mining engineer.

GEOLOGICAL FIELD-WORK DURING THE SEASON 1910

During the season of 1910 three field parties were sent out to do geological work in different parts of the province viz:—In Chibougamau region, in the Temiskaming district and in Gaspé peninsula.

For the last six years the Chibougamau region, which is situated some two hundred miles north-west of Lake St. John, has attracted a great deal of attention on the part of prospectors and capitalists. Various reports have been circulated among the mining public as to the great possibilities offered by the mineral deposits of the district. The official reports, however, published by the government as to its mineral resources, have all been the result of hurried examinations rather than of systematic field work. As the government has been strongly urged to take steps to have a railway tap this district to render it easy of access, the Honourable the Minister of Colonization, Mines and Fisheries before taking any definite action in this matter deemed it advisable to have as thorough an investigation made of the mineral possibilities of the district as was possible in a season's field-work.

To this effect a commission of three mining and geological experts of high standing and ability was appointed, with instructions to report on the mineral resources of the Chibougamau region from the standpoint of the justification on the part of the government to take steps towards the building of a railway.

The members of the commission thus appointed were Dr. A. E. Barlow, mining geologist, vice-president of the Canadian Mining Institute, member of the Royal Society of Canada, late of the Canadian Geological Survey, an authority on the pre-Cambrian geology; Professor J. C. Gwillim, professor of mining at the School of Mines of Queen's University, and Mr. E. R. Faribault, one of the prominent senior members of the staff of the Canadian Geological Survey.

A summary of their preliminary report and of their findings has been published and a final report and map will be issued shortly.

Another field party was sent in the Temiskaming region to study the rocks of Fabre Township to compare them with those of the Cobalt region. This work was entrusted to Mr. Robert Harvie, a mining geologist, whose report and map are being published separately. Towards the close of the season Mr. Harvie spent a few days in Dasserat and Boischatel townships, in the district immediately north of Lake Opasatica. Gold bearing veins have been discovered in this district and Mr. Harvie's notes on this occurrence are very interesting (see page 78). Mr. Harvie mentions the discovery of a mineral new to the Province, and in fact new to the eastern part of Canada. This mineral is Petzite, a Telluride of Gold and Silver. Its identification has a very important bearing on the possibilities of the gold deposits of the district. A very interesting point brought out by Mr. Harvie's investigations in the district, is the difference between the gold bearing quartz veins of the Opazatica region which are usually found in porphyrites of Keewatin age, and the large Laurentian quartz veins of the same region which are as a rule barren of gold. This distinction is very important indeed and should be a great help to the prospector in distinguishing one from the other.

The gold bearing quartz veins, as a rule contain a large proportion of ankerite, a carbonate of iron, which closely resembles calcite and gives a rusty residue on weathering. On the other hand, the veins of Laurentian quartz are usually much wider and on close inspection will show the presence of molybdenite, feldspar and pyroxene.

As Mr. Harvie mentions, a large proportion of the gold in the ankerite-quartz veins, may be present in the form of Petzite in which case it might easily be overlooked by the prospector in search of the yellow metal.

Petzite is a steel-grey to silver-white mineral resembling galena on a casual glance. But unlike galena it does not break into small cube crystals. Petzite is softer and more easily scratched than galena and is also heavier. (sp. grav. of Galena 7.5 of Petzite 8.7 to 9.2.)

The department of Public Works of Ottawa sent a party of engineers into the interior of the Gaspé peninsula to report on the water powers, forest and agricultural resources of the basins of some of the streams flowing into the Gulf of the St. Lawrence. Through the kind permi sion of Mr A. St Laurent, assistant-deputy minister of Public Works, we took advantage of this party to send with it a mining engineer, with instructions to report on the geology of the routes followed, and to devote particular attention to the possibilieties of the serpentine rocks of the region which constitute an extension of the serpentine belt of the Eastern Townships. This belt which to the south-west extends into the State of Vermont, contains the well known asbestos deposits of Thetford, Black Lake and Broughton, as well as important deposits of chrome ore.

Mr A. Mailhiot, a graduate in mining of the Ecole Polytechnique of Montreal was entrusted with the work.

On all of the parties sent in the field the technical assistants were chosen among the students of the Ecole Polytechnique,, of Montreal, thus affording, these young men an excellent opportunity to do practical work which will be a great help to them in the pursuit of their studies and in the exercise of their profession after their graduation.

Toronto national exhibition

Advantage was taken of the Toronto National Exhibition to make as good a display as possible, representative of the mining industry of the Provine of Quebec.

Good exhibits of Asbestos, Graphite, Mica, Ochres, Copper ores, Sulphur ores, Iron ores, etc....were prepared and the following extract of a letter from the Secretary of the Exhibition proves that the exhibit made a good impression and attained its object of diffusing knowledge concerning our mineral resources.

"I take pleasure in advising you that the exhibit of "Minerals made by the Quebec Government was greatly "appreciated by our Jury on Awards and they have award-"ded the Province of Quebec a Gold Medal for their Mine-"ral exhibit. A number of visitors at the Exhibition were

"greatly taken with the exhibit of Mica and Asbestos, as "well as the other Minerals.

"I am sure the exhibit from Quebec was a great reve- "lation to the many visitors to our Exhibition and must do "a great deal of good for your Province.

"I take pleasure in stating that the attendance this "year exceeded 825,000, a great many of them coming from "the nation to the south, as well as from Europe.

"We feel it must be a great benefit to the Province "to have the opportunity of drawing the attention of these "people to our varied natural resources."

I have the honor to remain,

Yours truly,

(Signed) J. O. ORR,
Manager Secretary.

QUEBEC MINING LAWS

In the last two years, the Quebec Mining Laws have been the subject of important, almost radical, changes, with the object of obviating the disadvantages which were found to exist in some of the dispositions of the act of 1892.

Briefly stated, under the previous regulations, exploration or prospecting permits were issued, giving the holder exclusive rights to all discoveries within certain areas not exceeding twenty-five square miles, in a radius of one hundred miles, at the rate of five dollars per square mile.

These permits were renewable every three months. They did not allow to mine, but only to prospect.

For mining, a license had to be obtained, on which two hundred acres of mineral land could be reserved at the rate of one dollar an acre.

The amendments assented to by the Quebec Legislature in May 1909 replaced the prospecting permits by the Miner's certificate, which corresponds to the Free Miner's certificate of Brithish Columbia and to the Miner's Licence of Ontario. This certificate, issued on payment of $10.00, gives the right to prospect for minerals on all lands, of which the Mining Rights belong to the Crown, without giving exclusive rights over large territory as did the exploration permit. The bearer of a Miner's certificate is allowed to stake five claims of 40 acres each, or a total maximum area of 200 acres. This may be held six months without having any payment to make. At the end of six months the holder has to take out a Mining License which gives him the right to exploit. This license is issued on payment of a rental of one dollar a year per acre.

Mining Lands can also be acquired by purchase at the rate of ten dollars an acre for lands situated 20 miles or more from the nearest railway and $20 for lands nearer than 20 miles.

During the season of 1910 and 1911 new amendments were introduced, reducing the rental rate, and the law as it is now in force provides for :— Issuance of Miner's Certificates; issuance of Mining Licenses at a yearly rental of

50 cents per acre ; all money paid on mining license goes towards the purchase price of the mining lands when purchase is made. Working conditions are enforced as follows :—work equivalent to 25 days of the labour of one man during the first six months and 25 days a year afterwards on each forty acres taken up.

MINERAL PRODUCTION OF THE PROVINCE OF QUEBEC DURING 1910

The general table given here under shows that during the year 1910 the total value of the products of our mines reached $7,323,281.—This is a very substantial increase as compared with the previous year and is by far the largest figure yet recorded.—It is probable that a part of this increase is to be assigned to a more complete collection of data and returns from producers of some of the non-metallic substances, such as building materials, mineral waters, etc., than was done in previous years, but nevertheless, as the individual items show in almost all cases higher figures than for the previous year, there is no doubt that the mining industry in the province of Quebec is in a healthy condition and is steadily developing.

For the purpose of comparison, the value of the various products mined during the previous year of 1909 is given in the last column. Moreover the following table gives the total value of the products of our mines for each year since 1900.

Year	Value
1900	$ 2,546,076
1901	2,997,731
1902	2,985,463
1903	2,772,762
1904	2,023,568
1905	3,750,300
1906	5,019,932
1907	5,391,368
1908	5,458,998
1909	5,552,062
1910	7,323,281

TABLE OF THE MINERAL PRODUCTION OF THE PROVINCE OF QUEBEC IN 1910.

——	Number of workmen.	Salaries.	Quantities	Value.	Value in 1909.
		$		$	$
Bog iron ore tons	*194	*24,474	1,207	4,406	4,688
Ochers.. .. " .	57	14,408	4,813	33,185	28,093
Chromite. . ' .			299	3,734	26,604
Copper and Sulphur ore.. " .	190	90,202	21,025	145,165	215,580
Asbestos.... " .	3730	1,544,262	80,605	2,667,829	2,296,584
Asbestic.... " .			24,716	17,612	20,468
Mica ..... lbs	152	41,346	251,419	51,901	27,034
Phosphate ..tons				3,182	4,800
Graphite .....lbs	98	24,900	309,400	15,896	10,339
Mineral waters .....galls	21	6,322	216,600	68,155	17,246
Titaniferous iron ore tons			3,528	5,292	.....
Slate.....	35	11,098	.....	18,492	24,000
Cement .....bbls	471	369,191	1,563,717	1,954,646	1,314,551
Magnesite ..tons			322	2,160	2,508
Marble.....	150	67,972	.....	151,103	130,000
Flagstone	6	700	.....	890	8,500
Granite	444	209,819	.....	291,240	149,064
Lime ...bushels.	218	100,611	1,152,312	279,306	105,489
Limestone	833	300,405	.....	503,173	457,143
Bricks . ...M	1206	291,071	128,951	906,375	584,371
Tiles, drain pipes, earthenware...	116	55,090	.....	197,526	125,000
Quartz .....tons.			805	2,013	.....
	7901	3,152,753		7,323,281	5,552,062

* Comprises operation of Blast-furnaces.

ASBESTOS

The returns received from asbestos producers show a total production of 80,605 tons of the various grades of asbestos, valued at $2,667,829 at the points of shipment. This is a substantial increase as compared with the shipments made in 1909, which totaled 63,965 tons valued at $2,296,584.

These figures represent the actual shipments made, and they are this year considerably less than the output, as a great deal of asbestos of all grades was reported as stock on hand on December 31st. As may be seen by the table given below, this stock on hand amounted to 41,159 tons, which, valued on the same basis as the shipments amounted to $1,921,923.

The activity of asbestos mining was very notable during the first seven months of the year. The mines were working night shifts as well as day shifts and most of the mills were producing to their full capacity. Unfortunately the demand did not keep pace with the increased output, and as a result the market became congested, prices dropped and the stocks on hand increased. Towards the end of the year several of the mines discontinued mining operations and a period of stagnation ensued. That this state of affairs is only temporary is shown by the past records of the asbestos industry. Periods of overproduction and consequent depression have been noted before, and these have always been followed by periods of healthy growth.

	SHIPMENTS			STOCKS ON HAND DEC. 31	
——	Tons	Value	Value per Ton	Tons	Value
Crude No 1.....	1,817	471,649	259,57	1,703	447,227
Crude No 2.....	1,612	196,382	121,82	3,181	440,884
Mill Stock No 1.	10,313	627,635	60,88	4,938	313,053
" " No 2.	44,793	1,141,374	25,48	24,417	621,065
" " No 3.	22,070	230,789	10,46	6,920	99,694
	80,605	$2,667,829	$33,10	41,159	$1,921,923
Asbestic	24,711	17,612	,71		

The value of the asbestos shipments made during the year 1910 is the highest recorded to date. The previous banner year was 1908 when it reached $2,551,596.

The following table illustrates the growth of the asbestos industry during the past decade:

Year	Tons	Value
1900	21,408	$ 719,416
1901	33,466	1,274,315
1902	30,634	1,161,970
1903	29,261	916,970
1904	35,479	1,186,970
1905	48,960	1,476,450
1906	61,675	2,143,653
1907	61,985	2,455,919
1908	65,157	2,551,596
1909	63,965	2,296,584
1910	80,605	2,667,829

The returns which we received from the producers show that a quantity of 2,035,705 tons of asbestos bearing rock was quarried during 1910. Of this rock about 25% is waste, which goes to the dumps without treatment as being too lean in asbestos for milling. Shipments of asbestos during 1910 and stocks on hand at the end of the year totalled 121,755 tons valued at $4,589,756 at the prices prevailing during the year. To arrive at the output, we may substract the stocks on hand at the end of the previous year 1909, which according to the Federal Mines Branch amounted to 20,921 tons. These figures leave a total extraction during 1910 of 100,837 tons of asbestos from 2,035,705 tons of rock mined or from about 1,500,000 tons of rock milled.

It must be understood that these figures are averages of totals. In the case of individual mines the figures of extraction may diverge considerably from these averages.

In last year's report, attention was drawn to some of the advantages which were likely to ensue from the amalgamation of individual asbestos properties into large corporations. One of these advantages was that it would be easier to establish a standard classification of the various grades of asbes-

tos. The importance of this point can hardly be exaggerated, for it is quite likely that one of the reasons which militates against a more rapid extension of the uses of asbestos and contributes to the dulness of the market, comes from the fact that at present there is a lack of uniformity in the grading and classification of the various products of the asbestos mills. Each individual producer has its own grades and marks which can only be sold to manufacturers and consumers by submitting samples. In the classification which we have adopted in the short table given above, we have followed the Federal Mines Branch, based on value per ton of the product. Crude No. 1 represents asbestos quoted $200 a ton and over, Crude No. 2, under $200. Mill stock No. 1, is the product of the mills of a value of $45 per ton and over, No 2 between $44 and $20 inclusively, and No. 3 under $20, but individual items of these groups vary widely between the limits assigned and the classification is arbitrary in the extreme. For instance under mill stock No. 1, we have grouped asbestos representing not less than 17 grades according to prices, which are designated by the following marks:— "No. 1"—"No. 1 A"—"No. 2 A"—"No. 2 B"—"A"—"C"—"D"—"M"—"X"—"XXX"—Long" — SPECIAL SPIN".

Similarly in Mill Stock No. 2 there are ten different prices and the products are classified as: "A"—"3 B"—"B"—"C" — "E"—"No. 2"—No. 3"—"X" — "XX" "OO"—"OK".

Whereas in Mill Stock No. 3, we get: "C"—"CC"—"F"—"N"—"D"—"E"—"SHORT F"—"No. 3"—"No. 4"—"No. 5"—"X"—"XXX"—"XX paper".

As may be imagined these various designations which have no connection between themselves, must to a great extent puzzle and bewilder the buyers, and selling by samples must necessarily be resorted to.

This subject of classification is very important, and it is thought that great benefits to the industry would be derived from a better standardization of the various grades. But of course such a result can only be achieved through a concerted action on the part of the producers.

Returns of shipments of asbestos were received from 13 companies, as follows :—

Amalgamated Asbestos Corporation,	Thetford Mines
Asbestos and Asbestic Co., Ltd.,	Danville
B. & A. Asbestos Co.,	Robertson
Bell Asbestos Mines,	Thetford
Belmina Consolidated Asbestos Co.,	Chrysotile
Berlin Asbestos Co.,	Robertson
Black Lake Consolidated Asbestos Co.,	Black Lake
Broughton Asbestos Fiber Co.,	East Broughton
Frontenac Asbestos Co.,	" "
Jacobs Asbestos Mining Co.,	Thetford
Johnson's Company,	Thetford
Ling Asbestos Co.,	East Broughton
Robertson Asbestos Mining Co.,	Thetford North

The serpentine belt of the Eastern Townships of the Province of Quebec, in connection with which are found all the deposits of asbestos at present worked in Canada, has for the last three seasons of field-work been the object of careful investigation on the part of Mr J. A. Dresser of the Geological Survey, and the gist of his observations as published in the summary report of the Geological Survey for the year 1909 is so interesting and important that copious extracts are here reproduced. It may be added that a map of the district which lies between the Chaudière and the St-François river is in course of preparation and will be issued shortly by the Geological Survey.

SUMMARY AND CONCLUSIONS

(J A. Dresser)

"Asbestos occurs in serpentine of two varieties which are thought to be of different ages. They may be conveniently called the Thetford and the Broughton types, and the rocks associated with them, the Thetford and the Broughton series, from townships in which they are well known.

Asbestos of the Thetford type occurs in veins, and is generally longer and stronger than that of Broughton.

Chromite also occurs in the Thetford series. The asbestos of Broughton occurs principally as "slip" fibre, which is more cheaply mined than that at Thetford, but being shorter and of less tensible strenth it has a lower market value. The Broughton asbestos deposits are often associated with talc or soapstone, which is not found in any important amount at Thetford. There are no deposits of chromite in the serpentine of Broughton.

In both quantity and quality of the minerals produced, much the greater value is obtained from the serpentine of the Thetford type. It forms the greater part of the serpentine belt and includes the mines of Thetford and Black Lake and Danville, with much of the intervening areas. It also extends southward beyond the St-Francis river.

The Broughton serpentine contains the mines and prospects of East Broughton and the vicinity of Robertson. The property of the D'Israéli Mining Company, Limited, in Garthby, and some prospects in ranges I, II and III of Tring also belong to this class.

The production of asbestos has increased steadily from the beginning of mining in the district, thirty years ago, to the present. It now has an annual value of $2,500,000.

Chromite occurs in workable deposits in the Thetford serpentine, but not, as far as known, in that of Broughton. The value of the annual production for several years has been about $80,000.

Soapstone, or talc, is found in important quantity associated with the Broughton serpentine, but not with that of Thetford. Some shipments were made from these deposits over twenty years ago, but a stable industry has not yet resulted.

The serpentine of the Thetford class has been derived by alteration from peridotite. The origin of the Broughton serpentine has not yet been satisfactorily determined, but it has doubtless been derived from the same, or from a closely allied rock.

In both cases the original rock was a member of a series of intrusive rocks differentiated from a single magma. The series comprises peridotite, pyroxenite, gabbro, diabase, porphyrite, and hornblende granite, the latter sometimes pass-

ing into aplite. The granite has usually been injected a little later than the other members of the series, and, therefore, in many places forms dikes and sills or intrusive sheets. These probably had a favorable influence in the formation of asbestos deposits, especially in the vicinity of Thetford Mines.

The igneous complex takes the form of a batholith, or thick lacolith, in the area between Thetford and Danville, and elsewhere is in sheets or sills. The serpentine of the Thetford type occurs both in sills and batholithic masses, while the serpentine of Broughton is only in sheets or sills.

The different rock varieties are arranged in order of decreasing density; in sills from the base upwards; in batholithic masses, from the center outward. This order is peridotite, pyroxenite, gabbro, diabase and porphyrite. The peridotite alters to serpentine, and the serpentine is purest and so most likely to carry asbestos, near the base of a sill, or the centre of a batholithic mass.

A result of this arrangement of the igneous rocks is, that, when the structure is known, the location of the purest serpentine may be determined. Most of the sheets dip towards the south-west, and in such areas the best prospecting ground is along the northwest side of the igneous belt. Where the sills dip to the northwest, the best prospecting ground is near the southeast border.

In the batholithic bodies serpentine is exposed only by erosion of the original rock masses. This has been most effective on the northeast side of the hills, that being the side against which the ice has moved in the glacial period. Besides the purity of the original peridotite, which is necessary that pure serpentine may form, the degree of alteration of peridotite to serpentine is an important factor in the formation of asbestos. The degree of alteration is indicated by the relative hardness of the rock. If the original rock were a pure peridotite —that, is, composed essentially of olivine— the more completely it is altered to serpentine the softer the resulting rock and the better the prospect for asbestos. Therefore, soft rock is a good indication of asbestos, if there is no soapstone present.

The presence of granite, also, seems to have a bearing

upon the occurrence of asbestos veins. The granite rock has generally been injected later than the other rocks; it fills fissures formed in the solid peridotite and forms dykes and sills. Either the fissuring or the action of the granite in filling the fissures has probably aided in forming asbestos.

Since the parent rock of the serpentine was a deep-seated one, and since the alteration to serpentine may occur at great depths, there appears to be no reason why the asbestos deposits also may not continue to as great depths—probably to the limits of profitable mining.

The chromite occurs in segregated masses, that are thought to be primary, in the outer part of the peridotite or serpentine portions of the batholithic masses, near the pyroxenite zone.

Chalcopyrite and pyrite occur in bodies of possible importance, in the diabase of Garthby and other places in the district. They are thought to be primary segregations.

Antimony occurs in South Ham, as a contact deposit in schists, adjacent to serpentine and diabase. The deposit contains native antimony, kermesite, valentinite and a little stibnite.

Platinum is known to occur in the drift, and this has come from the direction of the chromite deposits, which are the probable source of the metal."

Special attention is drawn to the fact that, according to Mr Dresser's observations, when the serpentine lies in sills or sheets, the part which is most likely to carry asbestos is the base of the sill, owing to an arrangement of the rocks according to their density, whereas when the rocks are in a batholithic mass the central part of the batholyth is usually more asbestiferous than the outward parts.

This would apply to the East Broughton area, where, so far, the principal work has been in the vicinity of the hanging wall. According to Mr Dresser it would be advisable to test the East Broughton serpentine near the northern edge, in the vicinity of the foot-wall where asbestos if present, would be more likely to occur in better defined veins.

During 1910 several new mills were put in operation ; as mentioned in last year's report, the tendency is now

towards constructing mills of much larger capacity than heretofore. The new ones which were started this year were as follows :

In Thetford the Jacobs Asbestos Company reopened the old Murphy mine, adjoining the Beaver mine, and erected a modern plant both as regards mining and milling. The initial work of opening the mine was very expensive owing to the heavy overburden of clay and superficial deposits which in places reached over 40 feet in thickness. But the results have been very satisfactory and the rock yields a very good proportion of crude as well as of mill stock.

The mill has a capacity of 750 tons of rock per shift of 10 hours.

The Bell Asbestos Co. has increased the capacity of their mill to about 500 tons of rock per shift.

The mine of this company presents more than ordinary interest in as much that they have adopted innovations radically differing from the old methods of mining prevailing in the district. The general practice is essentially open cast mining, but in the Bell Mine a great deal of underground development work has been effected.

There are now over 10,000 lineal feet of tunnels and drifts. The advantages derived from such a policy are twofold :— it proves and blocks out large tonnages which certainly increase the value of the property, and it also enables to work to much better advantage in the winter or during the periods of unfavorable weather. To offset these advantages there is the fact that this underground work is more expensive than the opencast quarrying.

Of course concurrently with this underground development work, quarrying has been actively pushed in the open pits, and in this connection another innovation has been adopted by the Bell mines. The general system in the district of hoisting the rock from the pits, which attain depths of 200 feet, is by means of steel cables stretched across the excavations. On these cables which at times have spans of 350 feet, runs a travelling carriage from which is suspended a box; this box can be lowered, raised and transported along the cable and dumped into cars placed at the edge of the pits. The cars are then made up into trains and hauled to the mill. The

Bell Mines are replacing their cable derrick system by hoisting through a long inclined tunnel of an average grade of 20 degrees. The cars are loaded on the floor of the pit by a travelling steam derrick and made up into rakes which are hoisted by a steel cable along the incline to the mill.

In the Black Lake district the salient feature has been the reopening of the old Southwark property on lots 27 and 28, range B of Coleraine Township and the exploitation of the Union Mine, by the Black Lake Consolidated Company. A tramway has been built connecting these two mines with a modern new mill erected by the company. This mill which is said to have a capacity of some 500 tons of rock per shift of ten hours differs from the others in using exclusively the Torrey Cyclone for the defiberization of the asbestos. This cyclone has been used for sometime at Danville, with very satisfactory results, but had not previously been installed in the Thetford-Black Lake region.

A new company, the Belmina Consolidated Asbestos Company, has acquired the Chrysotile Mine, on lot 25, range IV of Wolfestown Township and the Belmina Mine on lot 24, range II. The Chrysotile Mine was formerly worked by the Asbestos Mining and Manufacturing Company of Providence, Rhode Island, who had erected a complete mill. However all work on this property had been abandoned since 1908. During last summer the mine was reopened and the mill remodeled. The work of the company was concentrated on the Chrysotile property: the Belmina mine which is 2½ miles distant from the mill, was not reopened. The intention is to eventually connect the two mines by a tramway to bring the Belmina rock to the Chrysotile mill.

In the last three years the Broughton district has been the scene of active development. The mines of this district are situated on a strip of rocks, which Mr. Dresser calls the Broughton series, consisting of serpentine, soapstone and greenstone schists. These differ from the Thetford rocks in being softer, more shattered and more completely serpentinized. Deposits of asbestos are worked at Robertson, Broughton and East Broughton on the

Quebec Central Railway which are respectively six miles, 11 miles and 16 miles north-east of Thetford Station.

The Robertson Asbestos Company are working on lot 16, range IV of Thetford Township. A modern mill has been constructed of a capacity of 600 tons per 10 hours. The main equipment of the mine comprises 5 cable derricks with hoists and motors complete. In the mill are 6 cyclones of the standard type.

The Berlin Asbestos Company operate on lot 2, range V of Thetford township. During 1910 this company completed and put in operation a modern mill of a stated capacity of 500 tons of rock per 10 hours.

The B & A Asbestos Company began operating a mill, to treat the rock from their mine situated on lot 9, range VI of Thetford township. As originally designed this mill had a capacity of one hundred tons per 10 hours. It is now being altered by the addition of cyclones, hoists, etc., to bring its capacity to 350 tons a day.

At East Broughton we note the putting into operation of a new mill built by the Frontenac Asbestos Company of a capacity of 300 tons of rock per ten hours. This is on lot 13 range V of Broughton Township.

Previous to last year practically the total production of asbestos was exported, both in the United States and in Europe. Now a part of it is manufactured in Canada, the Asbestos Manufacturing Company having put up important works in Lachine, P.Q., where they make textiles, millboards, paper, cement, asbestos slates, shingles and sheathings. These latter products seem to meet with favour from the building trade. The office of this company is 236 St. James street, Montreal.

It is interesting to note that out of the 18 mines and 18 mills which were in operation during the year 1910 not less than 15 mills and 15 mines were obtaining their power from two electric power companies, viz: The Continental Light and Power Company and the St. Francis Hydraulic Company.

The first of these is a subsidiary company of the Shawinigan Water and Power Company, with a power plant at Shawinigan on the St. Maurice River of a capacity of

55,000 H.P. which is at present being considerably increased. The power is transmitted to Thetford, Black Lake, Robertson, East Broughton, Chrysotile and Danville, by means of two lines, each some 80 miles long, which cross the St. Lawrence river by means of cables, at a point two miles above Three Rivers.. These lines deliver 9000 H.P.

The power plant of the other company is on the St. Francis River, two miles above D'Israéli. The plant is for a development of 3000 H.P. This Hydraulic plant is supplemented by an auxiliary steam plant of 2000 H. P.

The cost of the power delivered to the asbestos companies varies with the importance of the consumption. As most of the mines and mills considerably reduce their operations or are closed down for about four months during the winter, the contracts for power are usually made for an eight months period at an average rate of $25 per H. P., large consumers paying slightly less and smaller ones slightly more than this average.

This is considerably less than the cost of steam power, as coal is quoted at between $5.00 and $5.25 at the stations on the Quebec Central Railway. It is probable that at these prices for coal the cost of power with the most efficient boilers would not be less than $40 or $50 per H. P. for the same period.

ASBESTOS IN FOREIGN COUNTRIES

United States.—According to J. S. Diller *. There are in the United States six asbestos localities of more or less interest to the asbestos industry. In the vicinity of Lowell, Vermont; at Casper, Wyoming, and in the Grand Canyon, Arizona the asbestos is of the chrysotile variety.—At Sall Mountain, Georgia ; at Kamiah, Idaho ; and at Bedford, Virginia are deposits of hornblende asbestos.

Of these, apparently the most important occurrences are the Vermont and the Wyoming deposits. The asbestos here occurs as cross fibre veins of chrysotile, in serpentine derived from peridotite, as in the Canadian deposits of the Eastern Townships.

(*) Journal Canadian Institute, Vol. XIV.

In the Grand Canyon, Arizona, the asbestos is found as cross fibre veins of chrysotile in serpentine, which rock lies in a thin layer in a magnesian limestone. The serpentine, like the limestone in which it occurs, is derived from material of sedimentary origin, and as to its original source is therefore in strong contrast with the serpentine derived from peridotite.

The serpentinous layer that carries the asbestos is usually from 12 to 14 inches, reaching 18 and 24 inches locally. In this layer may be present 2 or 3 parallel veins. Within this thin layer, containing the asbestos, cross fibre veins over an inch in width are common, locally reaching 4 inches.

The large proportion of crude to other grades in this Grand Canyon deposit is remarkable. Ordinarily such deposit could be profitably mined ; but the narrow limits of the asbestos horizon, taken in connection with its altitude and the difficulties of transportation in getting the asbestos to the railway, appear to render successful mining very problematical.

At Kamiah, Idaho, the asbestos is found in mass fibre, in dykes or lenticular bodies of amphibolite. The term "Mass Fibre" is used to indicate that the whole mass is fibrous, and that the fibre is neither cross fibre nor slip fibre, both of which are essentially vein deposits.

The Sall Mountain, Georgia, asbestos is of this type. mill fibre, or low tensile strength renders it much less valuable than all but the lowest grades of chrysotile.

The Sall Mountain, Georgia, asbtstos is of this type. According to Merrill, it is anthophyllite. The Sall Mountain deposits have been worked more or less sucessfully since 1894.

At Bedford Virginia, the Asbestos is found in slip fibre veins, in rocks of variable composition, though perhaps generally hornblendic. The asbestos is of the amphibole variety.

AFRICA—CAPE COLONY.—Asbestos occurs in the form of narrow veins, from one to five inches wide, in a dark shale at Westerberg in the Prieska district and at Kowgas in the Hay district. The output in 1908 totalled 1,149 tons valued at £19,436. (Statistical Register, Cape Town.) The

figures for the year 1909 are not yet obtainable but it is said that they will probably exceed 2000 tons.

RHODESIA *—Both chrysotile and hornblende asbestos occur in Rhodesia, and appear at the present time to offer a favourable field for exploitation. Chrysotile being actually a variety of serpentine our extensive areas of serpentine offer plenty of likely ground for prospecting. A pale green, rather decomposed looking class of rock appears to be the usual matrix. Large deposits of chrysotile have already been located and are now being opened up in the Victoria district in the neighborhood of a series of granite intrusions. The fibre, which is of excellent quality occurs distributed through a big body of serpentine in veins ranging up to 2 inches in width.

The following are analyses (1) of a surface specimen of chrysotile from Victoria (2) of the chrysotile recently opened up at Carolina, Transvaal, and (3) of a typical Canadian sample:—

	(1)	(2)	(3)
Silica	38.58	42.2	40.87
Iron Oxide..	2.53	0.25	2.81
Alumina..	3.21	10. 2	0.90
Lime..	2.90	trace	——
Magnesia..	28.87	31.07	41.50
Water...	14.10	15.40	13.55
Alkalies..	not det.	not det.	not det.
	99.19	99.12	99.63

The iron oxide in the Rhodesian sample is chiefly in the form of grains of magnetite which would be eliminated in the ordinary process of treatment. The lime is no doubt to be ascribed to surface alteration, resulting in its substitution for an equivalent quantity of the more soluble magnesia.

Hornblendic asbestos of long fibre occurs in the Tuli district, and near Victoria, but its inferior value is likely to prevent it from being successfully worked. The well-known blue asbestos, found near the Grange-River and exported

(*) From Mennell's "Rhodesian Miner's Handbook".

from the Cape is a fibrous form of a rather rare type of hornblende.

The total production of Rhodesian asbestos up to date (1910) is reported at 634½ tons.

TRANSVAAL.—The production of asbestos from the Transvaal for the year ending June 1909 is given as 221 tons valued at £7.400.

WESTERN AUSTRALIA.—The official statistics give the following figures as the production of asbestos in Western Australia.

1908—40 tons valued at.	£1600
1909— 2.83 tons valued at..	154

CYPRUS.—An austrian company called "The Cyprian Mining Company", Trieste, Austria, has been working a deposit of asbestos in the Troodos Hills, with satisfactory results. In 1907 their production was recorded as 89 tons valued at £564 and in 1908 it had increased to 472 tons valued at £1510.

RUSSIA.—As mentioned in our previous report (for 1909)—the important Russian mines of asbestos are situated 57 miles north of Ekaterinburg. In 1909 the production is said to have reached 14,500 short tons. Unofficial figures published in the Mining Journal, London, give the production of Russian asbestos in 1910 as 11,-450 tons.

IRON

The Canada Iron Furnace Co. had its two furnaces in blast during a part of the year. One of these furnaces is at Drummondville, in Drummond county, and the other at Radnor, Champlain county. The ore used at these furnaces is mainly bog iron ore produced in the immediate vicinity of the furnace plants, but a certain proportion of American and Ontario ores is also added. The fuel used is exclusively wood charcoal, and the pig iron made is of high grade, and is used for special purposes, such as car wheels.

The following material constituted the charges of the furnaces last year.

Ore charged—Bog ore	5987 tons
Foreign ore	1615 "
Charcoal	3860 "
Limestone	839 "

The pig iron made from these charges amounted to 3237 tons valued at $85,255.

The production of bog ore is decreasing yearly. In 1910 it was only 1207 tons, the balance of bog ore charged being taken from stocks.

As noted further on, some titaniferous ore was shipped this year from the St. Urbain deposits.

The operations of the Canada Iron Furnace Company and the mining at St. Urbain represent the actually producing operations in the iron industry in the Province of Quebec; but apart from these a certain amount of prospecting work, some of which of a very important nature, was carried on in various places, among which may be mentioned the Bristol mine ore deposits, the Iron sands of Batiscan and the Spaulding Township iron deposits.

The Bristol mine iron deposits were first opened in 1872, on lots 21 and 22 range II township of Bristol, Pontiac county. Mining operations were carried on, with interruptions, until 1894, and during that period considerable quantities of ore were shipped.

In the fall of 1909 a thorough magnetic survey of the deposits was made by Mr. E. Lindeman, of the Federal Mines Branch and an elaborate magnetometric map was made.

From his observations, published in a bulletin issued by the Federal Mines Branch, Mr. Lindeman concludes that very important ore bodies exist on lots 21 and 22, the existence of some of which had not previously been suspected owing to the heavy covering of superficial deposits.. Some extensive diamond drilling operations were carried on by E. J. Ennis and Co., of Philadelphia. Although the results are not made public, it is understood that they were satisfactory.

Some work was done on the Batiscan Iron sands deposits by Mr. W. J. Chapman, of Toronto. The intention is to concentrate these sands which according to analyses are much less titaniferous than those of the lower St .Lawrence.

The Megantic Iron ore Company has done some prelimi-

nary development work in the shape of stripping and trenching on the property which they control in Spaulding Township, Beauce County. The deposits of iron are on ranges VIII and IX, lots 6 to 14. The ore is a hematite mixed with jasper bands. The property is 12 miles distant from Megantic and 6 miles from the main line of the C. P. Ry.

TITANIFEROUS IRON ORES

For the first time since 1872 we record this year a production of Titaniferous iron ore which appears to mark the opening of a new era in the exploitation of these deposits.

Although small, the figures lead to believe that after a long period of rest some of these deposits are likely to give rise to quite an important industry.

In 1910, there were 3596 tons of titaniferous iron ore shipped from Baie St. Paul. This ore was mined from the extensive deposits of St. Urbain, which were worked in the early seventies as a source of iron ore.

A part of the Titaniferous ore mined in 1910 was shipped to the General Electric Company's works, at Lynn, Massachusets, where it entered into the manufacture of electrodes for certain lines of arc lights.

This ore, according to analyses made by the General Electric Company, has the following general composition :

Metallic iron	30 to 35%
Titanic acid	45 to 50%
Impurities	20%

The balance of the ore mined at St Urbain was shipped to the Titanium Alloy Co., of Niagara Falls, N.Y., where it was used in the production of certain steels and ferros.

It is a recognized fact that while titanium may be present in the finished products in only minute quantities, yet its addition to iron or steel in the course of their manufacture has a very beneficial effect, marked by increasing their tensile strength. It is probable that the action of titanium in this case is to eliminate injurious elements, such as nitrogen and oxygen.

Numerous enquiries were received this year at the office of the Mines Branch of the Province of Quebec for informa-

tion concerning these deposits of Titaniferous iron ores. On this account, it was thought useful to reproduce in extenso extracts of official reports previously published on these deposits. This information is scattered throughout numerous volumes, the greater number of which are now out of print, and it is difficult in many cases, for those who are interested in the matter to obtain all these details without laborious search. The reprint of these has the advantage of presenting the data we possess in a form which permits of easily refering to them.

EXTRACTS OF OFFICIAL REPORTS ON THE TITANIFEROUS IRON ORE DEPOSITS OF THE PROVINCE OF QUEBEC

In the form of Titaniferous ore or ilmenite, this element is very abundant in the Laurentian series, where it appears to belong to the anorthosites or triclinic feldspar rocks.

In St. Jérôme, Rawdon and Château Richer, it occurs disseminated in grains or in thin plates, which seem to mark the line of stratification, in the latter locality it forms masses of several ounces in a rock made up of andesine with a little hypersthene. In the parish of St. Urbain, at Bay St. Paul, great masses of ilmenite are intercalated in the stratification. One of these with a thickness of ninety feet was traced for a distance of three hundred feet and is said to be continuous with perhaps slight interruptions, for a distance of a mile. The ilmenite is sometimes penetrated by grains of a greenish triclinic feldspar which forms the surrounding rock, and it contains in many parts orange-red transparent grains of pure titanic acid. This ilmenite is coarsely granular or crystalline and has a density of 4.56—4.60. Its analysis gives titanic acid 48.60, protoxide of iron 37.06 peroxide of iron 10.42, magnesia 3.60.The ilmenite of Château Richer has a density of 4.85 and gives: Titanic acid 39.86; peroxide of iron, in part as protoxide 56.64, magnesia 1.44, insoluble quartz 4.90.

In the Seigniory of St. Francis, Beauce, there is a bed of granular iron ore, forty-five feet wide, in serpentine.

When crushed and washed, to free it from a small portion of earthy matter, it may be separated by the magnet

into two portions. About 2-3 is common magnetic oxide of iron while the remaining non magnetic portion is ilmenite, which gives titanic acid 48.60, peroxide of iron 40.70, magnesia 2.44, insoluble 4.20, water and loss 4.06—100.(*From "Geology of Canada" 1863—Geological survey, Ottawa.*)

BAY OF SEVEN ISLANDS

On a small stream known as the Rapid River, which empties into the Bay of Seven Islands there occurs, a few hundred yards from its mouth, a great mass of iron ore imbedded in the norite or labradorite rock of the country. The ore, with the exception of an occasional included portion of norite, appeared to occupy the bed and both banks of the stream for a breadth, east and west, estimated at about 500 yards and is said to extend for some distance North and South, but owing to a heavy storm at the time of my visit its limits mere not ascertained. The ore is black, brilliant and somewhat coarsely granular. It holds imbedded grains of feldspar with what appears to be pyroxene and some iron pyrites. Although pretty strongly magnetic, it contains a large amount of titanium, a partial analysis of an average sample yielding for 100 parts, prot. iron 49.77, metallic iron 30.70, titanium oxide 34.30—Insol. 6.35.

The other bases derived from a mixture of silicates were not determined. When pulverised and treated by a magnet it was separated into two portions, one strongly magnetic equal to 57%. The remainder gave by analysis 51.14 of titanic acid and 39.75 peroxide of iron besides 8.30 of insoluble residue. The magnetic portion, contrary to what might have been expected from the readiness with which it was attracted by the magnet contained not less than 4.80% titanic acid. It was nearly free from silicious impurities, and almost wholly soluble in hydrochloric acid. The existence of a highly magnetic compound containing so large a proportion of titanium is interesting and the substance deserves further study, meanwhile as an iron ore, it must take its place with the highly titanic ores, like that of Bay St. Paul to which reference has already been made. Should it ever be found advantageous to work such ores, the deposit of Bay of Seven Islands may be made to furnish a very large quantity.—*(From Report of Progress, Geological Survey of Canada,* 1866-69—*Dr. T. Sterry Hunt.*

TITANIFEROUS IRON ORE

This ore is found chiefly in rocks of Laurentian age, more especially in the upper Laurentian, and often in deposits of very considerable magnitude. Some of the ores of Brome and Sutton, in rocks of the Quebec group, belong here as they have been found to contain 20 to 30% titanic acid. In some instances, the titanic acid found in analyses of magnetic ores appears to be present as one of the constituents of the magnetite, but in other cases, it is due to the presence of ilmenite mechanically mingled with the magnetite. An example of a mixture of this kind noticed by Dr. Hunt in the rocks of the Eastern Townships has already been cited. Similar deposits would also be produced by the consolidation of the iron sands in the Gulf.

The largest deposits of ilmenite known in Canada is that at Bay St. Paul. It occurs in a rock mainly made up of triclinic feldspar, and frequently also contains grains of orange-red transparent titanic acid.

No 1 is an analysis by Dr Hunt and No 2 by late Dr Frederic Penny of Glasgow.

	No 1	No 2
Peroxide of iron	10.12	20.35
Protoxide of iron	37.06	29.57
Alumina		4.00
Lime		1.00
Magnesia	3.60	3.17
Titanic acid	48.60	40.00
Silica		1.91
	99.68	100.00
Metallic Iron	36.12	37.25

According to Dr Penny the ore contains no manganese, phosphorus or sulphur.

A specimen of Titanic iron ore from St-Jérôme, recently examined was found to contain.

Metallic iron	24.65
Titanic acid	32.36

Another from St-Julien, six miles from St-Lin, from a property belonging to Jos Barsalou of Montreal gave :—

Metal Iron .. .. 38.27 — Titanic Acid 33.67

This specimen was much weathered, but the gangue apparently consisted of a partially decomposed fe'spar. In the proportion of Iron and Titanic acid it comes very close to the Titanic ore from Bay of Seven Islands, which gave Dr Hunt 38.70% of metallic iron and 34.30 of titanic acid. The Bay of Seven Islands ilmenite occurs in Labradorite rock, and is said to form a very extensive deposit. Dr Hunt alludes to its being "pretty strongly magnetic", and this is the case also with the ore from St-Julien.

In the "Geology of Canada", page 501, some of the ores in the metamorphic rocks of Brome and Sutton are said to contain one or two hundredths of titanic acid. This amount would of course not detract from their value but it must be borne in mind that in the same region there are also deposits which on account of their large proportion of Titanic acid should be classed as titanic iron ores. Thus a finely powdered ore of a dark iron grey colour from the lot No. 9, range XI of Sutton gave:—Metallic Iron 40.87—Titanic acid 27.20.

With the glass it showed numerous grains of silica and occasional scales of mica or perhaps chlorite. It was but slightly affected by the magnet and gave a brown streak. A similar ore from the 8th lot range IX of Sutton gave :

Metallic iron 39.14—Titanic acid 29.86

Another from the first lot of R. III Brome gave

Metallic iron 41.46—Titanic acid 24.16

Like the others it gave a brown streak and was but slightly affected by the magnet. It contained a little quartz holding small quantities of carbonate of copper. (*Report of Progress Geological Survey of Canada* 1873-74, *B. J. Harrington.)*

SHAWINIGAN, QUE.—The occurrence of magnetite in the township of Shawinigan has frequently been reported

and during the past winter specimens of the so-called ore, said to occur on lots 19, 21 and 22 of VII were brought to the Survey Laboratory for examination. One of the specimens which was regarded by the owner as an especially rich iron ore consisted wholly of a heavy black pyroxene, while another was poor in iron and at the same time contained a considerable proportion of titanic acid. Quantitative determinations of iron and titanic acid in the specimen gave:

Iron	34.64
Titanic acid	10.07

It was readily attracted by the magnet, dark iron grey in colour, rather fine grained and associated with plagioclase feldspar, black hornblende, quartz, a little hypersthene. The owner of the specimens, needless to say was disappointed with the above results, as he had, without having had any previous examination of the ore made, spent a considerable sum of money on the property.

STE. JULIENNE, QUE.—Owing to litigation in connection with the deposit of titanic iron ore occurring in the Upper Laurentian rock, at Ste-Julienne, in the township of Rawdon, I have several times been called upon to examine specimens of the ore, by way of establishing its true character. The result has shown very little variation from the composition originally given:

Iron: 38.27. Titanic acid 33.67.

A specimen subsequently examined gave:

Iron: 40.71. Titanic acid 33.64.

while a third in which iron was not determined was found to contain 35.09% of Titanic acid. (*Geol. Surv. of Canada.—Report of Progress* 1876-77, *B. J. Harrington.)*

The formations which were met with are in the first place of the Laurentian, with a well marked area of labradorite in rear of Chateau Richer.

It contains small fragments of titaniferous iron ore like those which occur in the labradorite of the Saguenay.

but in much smaller quantities. (*Geological Survey of Canada* 1885. *Mgr Laflamme).*

Along the north side of St-Lawrence river, beds of magnetite have been reported at many points. Here the ore is found in two forms, viz: as massive beds interstratified with the gneiss and limestone of the Laurentian, or as massive beds of iron sand along the beaches, often of considerable thickness, and of great extent. These ores, while carrying a large percentage of magnetic iron oxide, also frequently contain a considerable amount of Titanic acid, so much so as in many cases to entitle them to be classed as ilmenite. Of these iron deposits probably the most important, as well as the largest known, occurs at Baie St-Paul, about fifty-four miles below the city of Quebec. Here an immense bed, having a thickness of 90 feet has been traced for some hundred yards. This great bed has a historic interest, having been discovered in 1666 by de la Tesserrie and some explorations were carried on in the following year by Colbert's orders under the sanction of the King of France. In spite, however, of the great quantity of ore at this point, it has never been found possible to carry on smelting operations with any degree of success owing to the large percentage of titanic acid in the ore, is seen by the analyses of Dr. Hunt.

Peroxide of iron..	10.42
Protoxide of iron..	37.06
Titanic acid..	48.60
Magnesia..	3.60

Two furnaces were however built at this place in 1872 by the Canadian Titanic Iron Company. The undertaking proving unprofitable was discontinued in 1880.

Similar magnetic iron ore is found at different points along the North shore. Near the mouth of the Rapid river, which flows into the Bay of Seven Islands, a great mass of of magnetite is found in the labradorite rock of that place. The ore is reported by Dr .Hunt to have a breadth on the stream of about 500 yards from east to west, and to extend some distance north and south. Assays of it give:

Protoxide of iron	49.77
Metallic iron	38.70
Titanic acid	34.30

On the beach at the mouth of the Moisic River there are also great deposits of iron sand interstratified with beds of nearly pure silica. Smelting works were erected there in 1867 which continued in operation for several years, being finally dismantled in 1876 or 1877. Similar deposits, in greater or less quantity, occur on the shore at Mingan, Bersimis, Tadousac and at other points along the north side of the St. Lawrence. While these vary somewhat in composition, by far the greater part are titanic ores. In the preparation of these sands for the blast furnace a large percentage of the magnetic part can be separated by an arrangement of magnets, and the titaniferous portion, which interferes with the easy reduction of the ores, eliminated.

North of Montreal, deposits of ilmenite, very similar in character to those just described, also occur, notably at St. Jérôme and near St-Lin. They have been examined by Dr. Harrington and that from St-Jérôme was found to contain:

Metallic iron	24.65
Titanic acid	32.36

While that from St-Lin had:

Metallic Iron	38.27
Titanic acid	33.57

Large deposits of similar ores are also reported as occurring along the Saguenay River; at Lake Kenogami and on islands at the outlet of Lake St-John.

In the country east and south of the St-Lawrence, considerable beds of magnetite occur in places. Some of these are titaniferous but others are remarkably pure and contain no titanic acid.

The presence of magnetite and hematite ores in Templeton, Buckingham and Hull is referred to in the Geological Survey Report of Progress 1866 (p. 20-21).

The presence of titanic acid in considerable quantity in some of these ores, tends to exert a prejudicial influence

on their value as easy smelting ores. The percentage in some cases has been determined and is given by Dr Harrington in the report of the Geological Survey for 1873-74. Thus the ore from lot 9, range XI of Sutton gives :

Metallic Iron..	40.87
Titanic acid..	27.20

From lot 8, range XI Sutton :

Metallic Iron..	39.14
Titanic acid..	29.86

and from lot 1 range III, Brome,

Metallic Iron..	41.46
Titanic acid..	24.16

A great bed of magnetic iron ore, or more properly ilmenite, forty-five feet thick, occurring on the Colway River, about four miles north of the Chaudière, in connection with the serpentine, is described by Dr Hunt as being separable with the magnet, after crushing, into two parts : about two-thirds of the whole being a magnetic oxide of iron, the remaining third being ilmenite containing 48.60% Titanic acid and 40.70 peroxide of Iron. The smelting of such ore is difficult from the great amount of fuel necessary to overcome the resistance offered by the titanic acid. These ores give generally a brown streak, and are but slightly affected by the magnet as a whole; other deposits in the township are not so highly titaniferous. Thus Dr. Hunt mentioned that some of these ores from Brome and Sutton contain 2% of Titanic acid. Assays of these ores, however have not been made for some years, nor have tests for the quantity of Titanic acid been made except in the few cases quoted. (*Geological Survey of Canada, Annual report* 1888-89.—*Dr. R. W. Ells.*)

Ilmenite.—Occurs in vast beds or masses in anorthosite rocks in the parish of St-Urbain at Baie St-Paul, and in a similar rock in Chateau Richer, and in Rawdon. Large deposits, associated with labradorite rocks, have also been observed near the mouth of Rapid River (Bay of Seven Islands), on the Saguenay River, on the shores of Lake

Kenogami and it has also been met with in several other localities in the Province of Quebec.—(*Geological Survey of Canada, Annual Report* 1888-89.—*Dr. G. C. Hoffman*).

Ilmenite, as before stated, appears to be a constituent mineral of the anorthosite rocks, in the rear of Chateau Richer, where besides being distributed through the rocks it is found in segregated masses up to 4 or 5 inches long and over one inch thick. According to Dr Hunt, this ore runs one hundredth of the mass and in places five-hundredths (*Geological Survey of Canada, Annual Report* 1890-91, *A. P. Low*).

The discharge of Lake MacKinac was followed to its discharge into the St-Maurice River, and along a tributary flowing out of Trout Lake, large masses of iron ore have been found in a dark greenish red gneiss, composed chiefly of orthoclase and epidote, but, as all the ore yet found contains a large percentage of titanic acid, it is practically of no value. Similar ore is found in a large quartz vein on the west side of the St. Maurice River, almost seven miles above the Grandes Piles and near Lake Bouchard, in the Seigniory of Radnor, and also in the township of Shawinigan, and about the lakes of the Laurentide Fishing Club. In the vein of Lake Bouchard a small mass of apatite was found associated with the iron, mica and pyroxene. (*Geological Survey of Canada, Summary Report* 1892. *A. P. Low*).

The St. Maurice River was next examined from Grandes Piles to its mouth. The rocks here were found to be like those of the lower part of the Batiscan River, inclined at low angles towards the east. The gneisses have a more basis character than those to the eastward, and in many places ilmenite or titanic iron ore is a constituent mineral. This is generally found in small grains disseminated through the rock, but at times is found in large masses, chiefly in pegmatite veins. (*Geological Survey of Canada, Summary Report* 1892. *A P. Low.*)

Throughout the great anorthosite areas of the

Labrador peninsula, Ilmenite or Titanic Iron ore is always found in more or less abundance, varying from small grains to masses several hundred tons in weight. The banks of the river passing through these areas usually have thick beds of iron sands scattered at intervals along them, these iron sands being derived from the desintegration of the anorthosite rocks. *(Geological Survey of Canada, Annual Report* 1895, *part. L.—A. P. Low).*

It has been the unvariable experience in Canada that the large iron ore deposits, common in these anorthosite rocks contain so much titanic acid that it has been impossible hitherto to work them profitably. Recent experiments, however, led to the hope that in the future, some of them at least may be smelted with profit. In order to determine whether iron ore, which is disseminated in small grains through the whole rock, was also rich in titanic acid, the iron ore of three hand specimens of the anorthosite from the different parts of the area was separated and tested. In every case the mineral was but faintly magnetic and gave a strong titanic acid reaction.

TOWNSHIP OF RAWDON, range II, lot 2.— This deposit is near the village of Ste-Julienne and although it has never been worked has attracted a good deal of attention. It occurs in the Morin anorthosite, near the eastern edge of the arm-like extension before referred to. The ore is found in a foliated white weathering variety of the anorthosite, rather rich in bisilicate with a strike varying from N. 8 W. to N. 25 W. and a nearly vertical dip. Several black dykes, apparently of diabase occur in the vicinity. The ore varies a great deal in character, being much purer in some places than in others, and often occurs in the form of bands, from a few inches to several feet in width, generally conformable or nearly so to the foliation of the anorthosite, but in a few cases cutting across it.

Both the anorthosite and iron ore are much twisted and faulted and it is difficult to determine whether the ore has been erupted through anorthosite or whether the cases where it cuts across the anorthosite are to be attributed to faulting. It however has a general trend in the direction

of the strike of the anorthosite, the principal mass being exposed for about 200 feet at right angles to this direction. The ore appears in reality to be a variety of the anorthosite and in most places too poor in iron to constitute an ore in the proper sense of the term. It is also highly titaniferous and contains iron pyrites as a frequent constitutent.

A specimen collected by me and assayed by Dr Hoffman was found to contain :

Metallic Iron..	42.29
Titanic acid	large amount

Two samples examined by Dr B. J. Harrington, formerly chemist to the Geological Survey, gave the following results.

No 1. Metallic Iron.. ..	38.27	No 2.. ..	40.71
Titanic Acid.. ..	38.67	.. ..	33.64

While a third in which the iron was not determined gave Titanic acid 35.09.

TOWNSHIP OF WEXFORD. Rang I, lot 7.— On this lot a small opening has been made in a dark-coloured, heavy massive rock, containing a certain amount of iron ore. The field relations indicate that this is merely a local variety of the Morin anorthosite, exceptionally rich in the darker coloured constituents of the rock and a microscopic examination proves this to be the case.

When thin sections are examined, the rock is seen to be composed essentially of a dark coloured pyroxene with plagioclase and iron ore. A not inconsiderable amount of apatite with a few grains of pyrite, garnet and biotite are also present. The proportion of iron ore is comparatively small, this mineral being entirely absent from some thin sections.

A specimen collected to represent the richest portion of the mass was examined by Dr. Hoffman with the following result :

Metallic iron..	20.27
Insoluble..	58.58
Titanic acid..	Decided reaction.

Not very far from this locality a remarkable case of local magnetic variation was observed in surveying the road between the Ste-Adèle and St. Sauveur, where it runs on the side line between the township of Abercrombie and the Augmentation of Mille Isles, on range X of the former township and thus near the margin of the Morin anorthosite. At one point on the road the needle suffers a deflection of 44° in a distance of 200 yards, returning again, further on, to its normal position. The road runs up a drifted valley and there are no rock exposures on it. The nearest exposures to the position of maximum deflection being 430 yards to the S. W. and 70 yards to the N. E. respectively. The rocks in both cases being the ordinary anorthosite of the district. Whether this variation is caused by a body of iron ore, and if so the position of the latter, can only be determined by a magnetic survey.

TOWNSHIP OF CHERTSEY. Range VIII, lots 5 and 6.—This deposit is also situated in the Morin anorthosite area, near its edge. It is as in the case of the occurrence above mentioned a variety of the anorthosite rich in iron. The anorthosite at this locality is rudely banded, some of the bands being poor in iron ore. Large exposures which are very rich in ore occur all over the southern part of lot 6. The ore, although it has not been examined chemically, is in all probability like the other iron ores occurring in the anorthosite, rich in Titanic acid. (*Geological Survey of Canada, Annual Report* 1895. *Part. J. F. D. Adams*).

The ores of titanic iron are principally met with in anorthosite rocks of the Upper Laurentian series, and as demonstrated further on, extensive beds on them exist in the Province of Quebec but unfortunately they have so far acquired no economic value on account of the extremely limited use of titanium in the manufacture of paints and dyes and the ore itelf being too refractory to be advantageously employed as iron ore. If industrial uses could be found for the titanium, we could supply the world with immense quantities.

ST. URBAIN MINE

This bed is remarkable from the fact that its working as an iron ore has been attempted. It occurs on lot 17, Seigniory of the Côte de Beaupré, Charlevoix county, near the village of St-Urbain, which is eight miles from Baie St-Paul. It is situated on a hill 100 feet high, in which the ore bed has a thickness of 90 feet, and is exposed for a length of 300 feet, followed by other outcropings for a distance of a mile. The ore is ilmenite (titaniferous iron) and is occasionnally found containing reddish grains of rutile (brookite), titanic acid. The mineral which is non-magnetic, shows the following compositition according to the reports of the Geological Survey of Canada:

Peroxide of iron..	10.42	20.35
Protoxide of iron..	37.06	29.57
Alumina...		4.00
Lime..		1.00
Magnesia..	3.60	3.17
Titanic acid..	48.60	40.00
Silica..		1.91
	97.68	100.00
Metallic Iron..	36.12	37.25

Analysis made at School of Mines, Paris.

Peroxide of iron..	47.60
Titanic acid..	10.60
Silica..	23.60
Alumina..	12.30
Lime..	3.30
Magnesia..	3.00
	100.40
Metallic Iron.	33.05

This analysis was made on a small sample containing probably a large proportion of rock.

An analysis of the St-Urbain pig iron, made at the same school, gave .03% of Titanium. By other analyses .05; .26, and 0% were found.

In 1871 an English company "The Canadian Titanic

Iron Company" erected at St-Urbain two blast furnaces, equipped with hot air blasts and a complete plant, and laid down a tramway to the river St-Lawrence.

The company also secured a certain quantity of wood lands to manufacture the charcoal for the furnaces, and limestone quarries were further opened in the neigboorhood. The furnaces went into blast in November 1872 and worked until May 1873, producing about 500 tons of excellent pig iron. But owing to the refractory nature of the ore, 200 to 300 and even 400 bushels of charcoal were required to make a ton of pig iron and under the circumstances, the company closed its works,went into liquidation, and sold off the plant at low price. In 1880 the last of the plant was removed. This attempt definitely settles therefore the question of the titanic ores which, however, have been sometimes employed mixed with other ores, for the hearths of puddling and rebeating furnaces. The causes of their failure in other respects are traceable especially to the low percentage of iron and the refractory nature of the ore, but the quality of the product obained was good.

OTHER BEDS

Deposits of titanic iron occur under the same geological conditions at several other points which it is sufficient to merely mention, namely at St-Jérôme (Terrebonne) at the river Duclos in the township of Bourget (Saguenay) and at Bay of Seven Islands, on the North shore of the Gulf of St-Lawrence, the ore at the latter place being also magnetic and showing the following composition:—

Protoxide of iron	49.77
Titanic acid	34.30
Insoluble	6.35
	90.42
Metallic iron	38.70

The difference to 100 arises from the iron being indicated as protoxide.

It is also found at Chateau Richer (near Quebec) and Rawdon (Montcalm).

All these ores are similar, in their composition, to those of St. Urbain, containing 30 to 40% of titanic acid and the same proportion of metallic iron.

It should also be mentioned that the magnetic sands of the North shore also contain a large proportion of grains of titanic ore.

TITANIC IRON IN THE EASTERN TOWNSHIPS

In the North-Eastern corner of the Seigniory of Rigaud, Vaudreuil, Beauce, at a short distance from the river des Plantes a bed occurs in the serpentine, with a thickness, it is said, of 45 feet and composed of magnetic and titanic iron, which can be separated mechanically. It exists in the proportion of two-thirds magnetic iron to one-third of titanic iron ,and presents the following composition, according to the reports of the Geological Survey of Canada.

Peroxide of iron	40.70
Titanic acid	48.60
Magnesia	2.44
Insoluble	4.20
Water and loss	4.06
	100.00

In the iron beds of Brome and Sutton, there is a proportion of titanic acid to the extent of 1 or 2 %, susceptible of increase, occasionnally so as to convert the ore in question into genuine titanic iron.

LIST OF TITANIC IRON LOCALITIES

Beauce.—Seigniory Rigaud Vaudreuil.

Brome.—Brome, lot 1, range III.

Sutton, lot 8, range IX, lot 9, range XI.

Charlevoix.—Seigniory Côte de Beaupré, lot 17 (St. Urbain).

Chicoutimi.—Bourget Range I, lots 34 and 35.

Montcalm.—Rawdon Range II, lot 2, St-Julien.

Saguenay.—Côte Nord, Baie des Sept Iles.

Terrebonne.—Augmentation Seigniory des Mille Iles.

Champlain.—Radnor I, lot 28.

Mines and minerals of Quebec, 1889, *J. Obalski.*

ST. URBAIN MINE

Nine miles from Baie St-Paul, Gulf St-Lawrence.

This mine was worked in 1870: two blast furnaces had been built using charcoal. A certain quantity of metal of good quality was obtained and then the whole was abandoned. The company went into liquidation, the plant and the machinery were sold and disposed of and to-day only a few ruins remain. The last time I visited the mine was in 1898. It is situated on a hill 600 feet above sea level, on lot 17 Seigneurie de Beaupré, wich corresponds to No 364 of the cadastre of St-Urbain. There is a considerable deposit visible, which was opened at three principal points over a distance of two acres towards the N.-W. The first opening was made on a well exposed breast of solid ore 100 x 100 feet with a height of 20 feet without taking into account the parts concealed beneath the trees or the surface rocks. The second opening shows a face of 30 feet high by 60 wide, the surface being covered with forest. The third is a cutting in the ore bed, 100 feet long by 50 wide and 50 high. From these excavations, a large quantity of ore was taken out, of which several thousand tons remain piled up on the spot. In reality, these exposures may be said to form but a single mass, which I traced for a distance of about 400 feet with a breadth of over 100 feet. According to the statements of the inhabitants of the place, the surface indications continue for a distance of about 500 yards towards the north-west, at the extremity of which there is a still more extensive body of ore.

The quantities in sight are very great and run up into thousands of tons. The ore contains about 50% oxide of iron corresponding to 37% metallic iron, and 40 to 50% Titanic acid.

It is very compact and but very little mixed with rock. It holds crystals of ilmenite, brookite and rutile; some specimens are slightly magnetic.

Seven Island Mine.—This deposit may be compared to that at St-Urbain and contains considerable ore. It is

situated on Harbour of Seven-Islands, which is open for six to seven months during the year.

In Bourget, Chicoutimi.—Range I, lots 34 and 35, on the left bank of the Saguenay, there is a big deposit in the shape of two hills of about 100 feet high. This mine is pretty far from lines of communication. It is possible that this mass is connected with the other indications found to the south of the Saguenay on ranges IV and V of the township of Kenogami.

On lot 28, range IV of that township a mine has been opened near Dorval Station, on the Line of the Lake St-John Railway and a hundred tons of ore have been taken out. This deposit covers a pretty large surface on a hill 80 feet, where the prospecting work has exposed a thickness of 4 to 5 feet solid ore in which the proportion of Titanic acid does not appear to exceed 5%. (*Mining operations in the Province of Quebec during* 1898. *J. Obalski)*

KENOGAMI MINE

The deposit at Kenogami, county of Lake St-John, was opened up a little and some ten carloads were shipped to Radnor. I had occasion to inspect this deposit, and I ascertained that it extends for ¾ of a mile to the north of and along the line of the Lake St-John Ry., with a width in the interior which I was unable to determine, but which doubtless extends pretty far and is probably connected with the deposits in the township of Bourget, on the left bank of the river Saguenay. The quantity of ore is consequently consierable and easily accessible. The bearing rock is anorthosite and forms low hills in which the ore appears to occur in big pockets. It is not of equal purity, nor does it contain an equal proportion of titanium all over. A specimen of average appearance gave 10.36% of titanic acid.

SEVEN ISLAND MINE

Last summer, I visited this mine, which is situated at about two miles from the Bay of Seven Islands, and on both sides of the Rapid River. It is composed of masses of ma-

gnetic iron holding heavy proportions of titanium and outcropping on the banks themselves of the Rapid River, where I followed them for a distance of about 500 yards in solid thicknesses of 15 to 20 feet. I found similar indications at some distance from the river, where the ore occurs on hills of about 100 feet high, among others to the north west, where one of these hills forms a solid mass, being a continuation of the one visible on the right bank. The rock is anorthosite.

This ore was worked a little about 35 years ago by the Moisie Company and I am told that some of it was used in these forges. There are still some piles on the ground which were then prepared and the traces of an old road. The Bay of Seven Islands, which is a fine harbor, is about 300 miles from Quebec.

Other deposits of titanic iron have been observed in the neighborhood of Chicoutimi and near the Grand Discharge of the Saguenay.—(*Mining operations in the Province of Quebec during* 1901.—*J. Obalski.*)

EXPERIMENTS MADE ON IRON ORES BY MR. J. WALTER WELLS, IN THE LABORATORIES OF THE KINGSTON SCHOOL OF MINES

Sample from Rivière Chaloupe, North shore of St-Lawrence and containing magnetite intermixed with ilmenite and pyroxene. The ore was crushed in a jaw crusher and passed through rollers, the products analysed to see which size carried the most titanium which is the only deleterious element present. The results are:—

Size	Weight	Titan. ac.
Held on screems 0.2'' holes	20 oz.	16 22
Held on screens 0.10''	2 lbs	15.95%
Through screens 0.10	5 lbs. 6 oz	18.48

Results show same amount of titanium in each size.

The two smaller sizes were passed through magnetic separator.

Size	TiO_2 in ore	TiO_2 in concentrates
Held on 0.10'' screen	15.95%	13.62%
Through	18.48	7.82

The results show that fine crushing is necessary in order to free the ilmenite from mechanical combination with the magnetite.

	Average ore	Heads
Weight	5 lbs. 6 oz.	3 lbs. 3 oz
Metallic Iron	44.10%	38.58%
Titanic acid	18.48	7.82

Sample F. was taken from the large deposits near Seven Islands, and contains magnetite intermixed with pyroxene and ilmenite.

The ore crushed, rolled and sized gave the following percentages for titanium which is the only objectionable constituent present.

	Weight	Titanic acid
Held on 0.20'' screen	1½lbs	29.74%
" " 0.10'' "	4 "	26.33
Thro " 0.10'' "	7 "	31.78

The finest crushed was passed through the magnetic separator.

	Av. ore	Heads
Weight	7 lbs	4 lbs 9 oz.
Met. Iron	43.59%	51.69%
Titanic acid	31.78%	15.16%
Titanium		9.40%

Sample G came from Kenogami, Saguenay, and contained magnetite, ilmenite and silica.

The sample crushed, rolled and sized gave the following results:

	Weight	Titanic acid
Held on 0.20'' screen	2 oz.	21.17
" " 0.10'' "	12 "	17.07
Passing 0.10'' "	1 lb. 10 "	23.32

The finest sized product passed through the magnetic separator gave the following results:

	Average ore	Middles	Tailings
Weight	1 lb., 10 oz.	1 lb.	10 oz.
Metallic Iron	42.74	52.47	25.88
Titanic acid	23.32	6.42	

The results show a considerable elimination of titanium but the iron contents have not been raised much owing to rock matter adhering to the ore.

The results indicate that in special cases it will pay to introduce magnetic concentration especially near water power and good shipping facilities. *(Mining operations in the Province of Quebec during* 1902.*)*

In last year's report we mentioned the experiments made by Mr. Walter Wells, with various specimens of titanic iron from our province, with the view of ascertaining whether it would be possible to enrich them and whether the titanium could not be got rid of by means of magnetic concentrators.

Further results, although still insufficient were obtained by a fresh experiment on two tons of ore from Seven Islands on the North Shore.

ANALYSIS OF CRUDE ORE

Peroxide of Iron	22.02
Protoxide of iron	33.60
Bisulphide of iron	.90
Alumina	7.24
Titanic acid	26.49
Silica	4.26
Lime	2.22
Magnesia	2.53
	99.26
Metallic iron	42.5

The concentration was effected with a Wetherill electromagnetic separator.

17 lbs crushed to 30 meshes *(0.05 inch)*, yielded 9½ lbs of concentrates.

Iron	53.36%
Titanic acid	19.19.

and 7½ lbs tailings containing

Iron	27.60
Titanic acid	35.59

40 lbs crushed meshes yielded 26½ lbs concentrates.

Iron	49.9
Titanic acid	20.6

and 14½ lbs tailings.

Iron	28.72
Titanic acid	34.77

The remainder of the two tons,representing 3,417 lbs,was crushed to 30 meshes and yielded 2,221 lbs concentrates or 65% containing 18.8 Titanic acid.—*(Mining operations in the Province of Quebec during* 1903.—*J. Obalski.)*

A deposit of iron ore situated in the northern corner of this seigniory was mentionned a long time ago in the reports of the Geological Suvrey but never located since. During the year, residents of Beauceville made search for it and found a short distance from the Rivière Des Plantes in the St. Charles range, a rather considerable body of titanic iron which at a point showed a width of twenty feet. Other prospecting was done in a north easterly direction, and the same ore was found at a distance of one mile further, between the St. Charles and St. Gaspard ranges. Lastly, on a block at the northern corner, pretty extensive work was done in the way of cuttings and a shaft of 20 feet, which revealed for a distance of 100 feet a mass of ore showing a maximum width of 35 feet. These deposits seem to occur in the same zone, in a north easterly direction and are met with in the serpentne strip, following the Rivière Des Plantes. (*Mining operations in the Province of Quebec* 1903, *J. Obalski*).

Another important deposit of Titaniferous iron ore is reported as occurring on Ile d'Alma, Lake St. John, on lot 36, range II. A specimen of this ore analysed in the laboratory of Milton L. Hersey, Montreal, gave: Metallic iron, 56.3%, Titanic acid, 18.7, Sulphur, none, Phosphorus, .0061.

Reports have also reached the department of Mines of the occurrence of a large deposit on lots 37 and 38, range V., Beresford township, Terrebonne county.

The Titaniferous Iron ore deposits in the vicinity of the Colway River, in Beauce county, are quite extensive, as indicated by pits, surface strippings and dip needle observations. They extend in a broken band, over a distance of nearly four miles. From analyses of samples taken at different places, the ore varies between 35 and 45% Metallic Iron and 10 to 15% in Titanic acid.

OCHRE

There is nothing new to record concerning the ochre industry of the Province. The center of operations is in the neighborhood of Three Rivers, at St. Malo, where very extensive deposits of ochre have been worked for many years.

The annual production of ochres does not vary very much, but nevertheless the figures received show a steady increase from year to year. The production which was valued at $18,825.00 in 1904 has now grown to $33,185. The ochre is essentially a hydrated oxide of iron which is mainly used in the manufacture of paints, but a certain proportion is used for the purification of lighting gas, for which purpose it is employed in the raw state.

Although the production of ochres in the Province of Quebec is for the present limited to the Three Rivers district, there are numerous other large deposits known in various parts of the Province. Dr R. W. Ells in his bulletin on the Mineral resources of the Province of Quebec mentions among other places, lot 15, range X, Township of Hull; Seigniory Pointe du Lac, St. Nicholas range; Ste-Anne, Montmorency, where very large deposits of ochres, are reported to occur.

COPPER

The copper bearing ores now produced in the Province of Quebec come from the cupriferous pyrite deposits of the Eastern Townships. This ore is primarily used in the manufacture of sulphuric acid and the cinder is sent to the copper smelters for the extraction of the copper.

The production of ore in 1910 was the lowest recorded since 1904 being 24,040 short tons, a decrease of 11,060 tons as compared with the previous year.

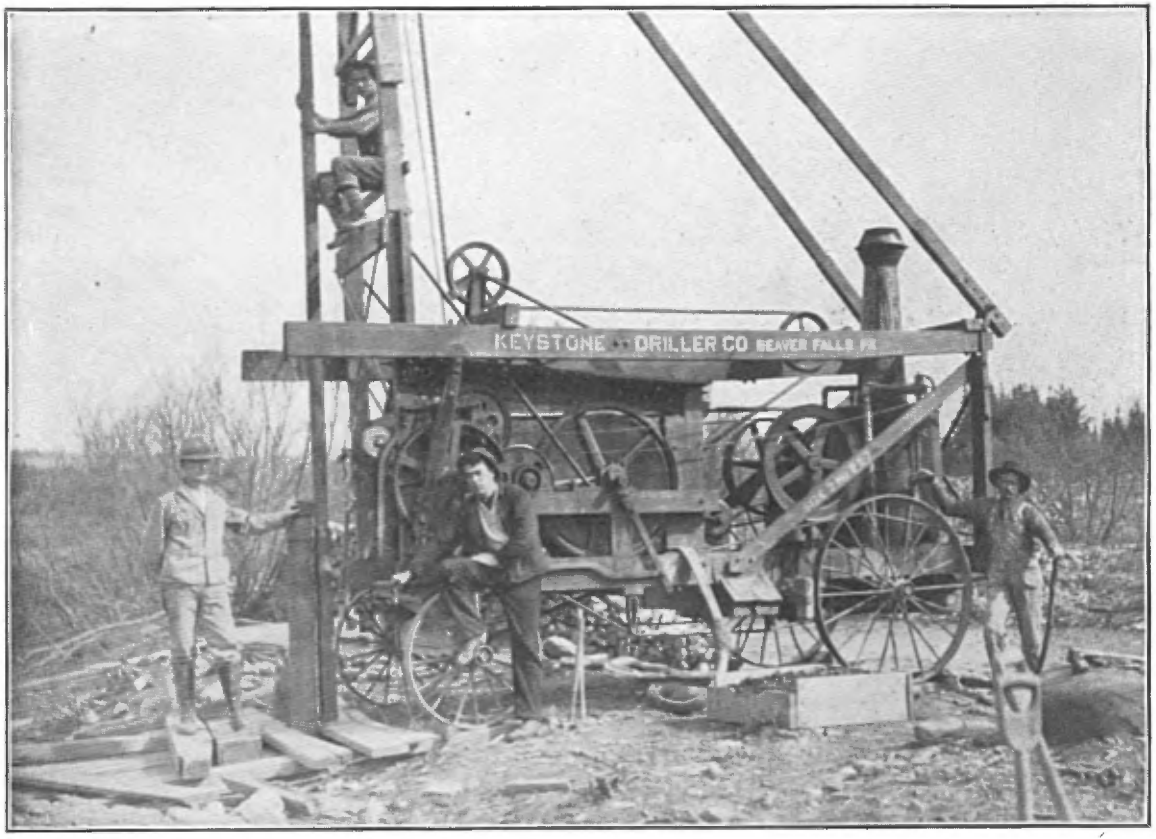
Year	Tons
1893	64,960
1894	47,132
1895	42,470
1896	47,730
1897	41,233
1898	39,968
1899	43,599
1900	37,791
1901	22,732
1902	31,938
1903	26,481
1904	23,729
1905	28,644
1906	32,527
1907	29,574
1908	26,598
1909	35,100
1910	24,040

The Eustis mine was the principal shipper. This mine which is situated at Eustis, on lot 2, range IX township of Ascot, nine miles south of the city of Sherbrooke, began operations as far back as 1879. The ore occurs in lenticular masses, the sizes of which greatly vary in width, between a few feet and 75 feet. The lenses are usually connected by narrow veins which sometimes pinch down to an inch or less.

The length of the main slope of the Eustis mine is now over 3000 feet long, on an angle of 40°. The head of the slope is reached by a rock tunnel, 1000 feet in length.

The ore is concentrated in a mill which is situated 3000

GOLD.—Testing alluvial ground on Gilbert River with Empire drills.



GOLD.—Testing alluvial deposits on Gilbert River, with Keystone Drill.

feet from the top of the slope and it is shipped mainly to Boston where it is used in the manufacture of sulphuric acid. The copper bearing cinder is then sent to West Norfolk, Virginia, where the Eustis company has a smelter in which are also treated some of the Virginia ores.

Some shipments are also made to the Nichols Chemical Company at Capelton, Que.

It is interesting to note that the manager, Mr Adsit, saved this year an appreciable amount of copper by the simple process of passing the mine water over scrap iron.

We record this year comparatively important shipments of copper and suphur ore from the McDonald mine, at Weedon, on lot 22, range II Weedon, which has been under active development work for two years. This mine is worked by the East Canada Smelting Company.

The ore of this deposit consists of iron pyrites and chalcopyrite, occurring as lenticular masses, in more or less altered schists. The occurrence resembles closely that of the deposit which is worked at the Eustis Mine. The main body of ore has been proved to be over 500 feet long and to have a maximum width of 50 feet. It is likely that further development work will reveal other lenses.

The lense which has been developed has the same strike as the county rock, N 40° E, and dips to the S. E. at an angle of 45°.

The deposit has been developped to a depth of 110 feet by means of two shafts, 100 and 110 feet deep respectively. The latter is now being sunk to the 200 feet level. More than 700 feet of levels and crosscuts have been driven.

Shaft No 1 is equiped with a 15 HP. hoist, which can handle 70 tons per shift from a depth of 400 feet. The boiler equipment consists of two horizontal boilers and one vertical boiler aggregating 200 HP.. The compressor plant comprises two Rand straight line compressors capable of running 8 drills.

Substantial shipments were made to the Capelton Chemical Works of ore said to average 44% sulphur and 5½% copper.

The Albert mines in the same district, which shut down

some two years ago, have not been re-opened. The workings are now full of water. Some prospecting work was done on several of the old mines, but nothing of note resulted.

A. O. Norton continued his prospecting and development work at the Suffield mine, but no ore was shipped. The deposit worked here is a low-grade silicious ore, which consists of a mixture of chalcopyrite, pyrite and a little bornite. The shaft is 400 feet deep and there are 700 feet of drifts at various levels. The surface plant consists of a steam boiler of 100 HP., a hoisting engine of 50 HP. and a 4 drill air compressor.

Mr. Norton has also reopened the Marrington mine on lot 6, range V, Ascot Township and did some prospecting there with the help of a small 20 HP. boiler and hoisting engine. The drilling was done by hand. The shaft is 265 feet deep and there are 500 feet drifting.

At the Hepburn mine, lot 7, range IX, Ascot Township, the Eustis Mining Company did same work of re-opening and prospecting.

The Ascot mine, lot 8, range IX, Ascot Township, was prospected by Mr. John McCaw of Sherbrooke, for the East Canada Smelting Company, but no ore was shipped.

On lot 24, range V of Cranbourne, a little work was done on a deposit which is said to contain bornite and chalcopyrite.

In the Beauce district considerable prospecting work was done on two deposits in the vicinity of St. François. These deposits consist of quartz veins and lenses cutting eruptive rocks largely serpentinized and containing chalcopyrite and a little bornite.

In the fall of 1909 work was begun on the erection of a small copper smelter at Actonvale, by Mr. P. Tetreault of Montreal. The intention was to treat the ore from the dumps of the old Actonvale mine, as well as to do some custom work. The plant was completed and the furnace blown in during the spring of 1910. It consists of an Allis-Chalmers water-jacketed furnace, of a capacity of 80 tons of ore a day; one Root blower of a capacity

GOLD.—DOMINION GOLD FIELDS, LTD.
Elevator and Stacker.

GOLD.—DOMINION GOLD FIELDS, LTD.
Monitor, pipe line and elevator on Des Meules creek.

of 6,600 c. f. of air per minute; one 80 H.P. boiler and other accessories. After a short run the operations were discontinued to make alterations. The plant is still in the experimental stage.

The old Ascot Mine was unwatered and some sampling was done.

On the whole the copper industry of the Eastern Townships was not very active during 1910, owing in a measure, to the low price of the metal which prevailed during the year. But other reasons also militate against an active resumption of work. One of the main causes, as remarked by Dr. Wilson, who studied the question for the Federal Mines Branch in 1909, is the attitude assumed by the majority of owners of undevelopped and unexplored prospects, who usually have high pretentions and disproportionate ideas as to the value of such prospects. The owners will not as a rule assume the risks of development and yet ask prohibitive prices for their properties, and often are not even willing to give facilities to have them tested. Instances have come to our notice that thousands of dollars are asked for mere copper-bearing outcrops, on which no work beyond a few days stripping have been done.

GOLD AND SILVER

Although there was no production of precious metals in the province of Quebec during 1910, it may be mentioned that the Dominion Gold Fields Limited, who have acquired the mining rights on the Rigaud-Vaudreuil Seigniory, in Beauce, proceeded actively with testing and development work to begin mining the alluvial leposits in the early part of the spring of 1911.

The plant is now practically completed and operations will begin at an early date.

The progress of this entreprise will be watched with great interest, for to a great extent, on their success depends the renewal of mining activity in the gold-bearing alluvions of the Eastern townships.

This company possesses mining rights on an area of 70,000 acres which comprise some of the richest ground of

the region, for it is from this seigniory that the greatest part of the gold produced in the sixties and seventies was extracted.

The company proceeded very systematically. The whole season of 1910 was devoted to a thorough testing, by means of Empire drills and a Keystone drill, of the most favorable points to start operations. It was finally decided to begin by hydraulicking work on the DesMeules Creek, at a point one mile in a str ight line, to the south-west of Beauceville: and in the fall of 1910, the construction of the plant was begun.

Water for the monitors is obtained from Lac Fortin, a sheet of water which measures one and a half miles, by three quarters of a mile is its extreme dimensions. A ditch nearly seven miles long, of which distance about 4500 feet is flumed, brings the water to a penstock, from which starts a rivetted steel pipe line 18 inches in diameter which tapers to 15 inches. The ditch itself in cross-section is 5 feet at the top, 3½ feet at the bottom and 3 feet deep, while the flume is 4 feet by 4 feet. At a distance of 1400 feet from the pens'ock this pipe line branches off into two 10" lines, each 500 feet long, terminating into monitors or giants. Each has a set of three nozzles, of two, three and four inch openings. One of these monitors will be used for cutting the bank, and the other for driving the gravel through a bed-rock sluice to the elevator pit.

The fall from the penstock to the monitors is 260 feet. The bottom of the sluice is on bed rock, and as the strata are highly inclined, the surface offers natural corrugations, well adapted for sluicing, without having to put in blocks or riffles.

At the end of the sluice, a bucket-elevator, equipped with a stacker, built by the New-York Engineering Company, has been installed to take c re of the taillings, and to save whatever fine gold was not saved in the bed-rock sluices.

The capacity of the elevator is for handling 2000 cubic yards per day. The intenti n is to work three shifts a day, from April to November. The elevator is electrically driven. The tailings are raised forty feet, by a

GOLD. —Dominion Gold Fields, Ltd. —Penstock and 18 inch pipe line.

chain of buckets, each of which has a capacity of 1½ cubic feet and weighs 550 lbs. The buckets empty into a steel-plate sluice and the material is driven to the end of the stacker, along the elevated sluice by a powerful flow of water suplied by a centrifugal pump, electrically driven, having a capacity of 6000 gallons a minute.

Power is supplied from a steam power-house, built near the station at Beauceville. The equipment consists of two Goldie McCulloch Boilers of 100 H. P. each, one engine of 220 H. P., Jerome Wheelock system, with a fly-wheel 15 feet in diameter.

Superheaters for boiler water, injecting pumps, fan for force draft, etc.

The engine drives a 150 K. W. dynamo installed by Allis-Chalmers-Bellock.

The power is transmitted to the field of operations by a copper transmission line, 8000 feet long at a voltage of 2200, which is reduced by a transformer to 440 volts.

The plant of the Dominion Goldfields is in charge of a staff of californian miners of great experience, and nothing is being neglected for the success of this enterprise.

This is the first installation of its kind in the alluvial gold fields of the Eastern townships, and the results are awaited with great interest.

Other prospecting work has been carried on in the township of Ditton, on the Ditton River, by the Alleghany's Gold Mining Company, as well as on the Moes River in the township of Compton by Geo. H. House and others.

In the North-Eastern part of the Province of Quebec, in the region South of the Transcontinental Ry. a great deal of prospecting and exploring was done in the fall of 1910. Some promising discoveries of gold bearing quartz were reported which gave rise to a rush in the district of Keckeek Lake, 30 miles South of the railway and 40 miles East of the interprovincial boundary. This activity was continued throughout the winter and in the spring of 1911. In May, 1911, some 400 claims covering an area of 25,000 acres had been staked out and registered at the Ville-Marie Office of the Department of Mines.

In view of this activity, the Bureau of Mines is taking steps to organize an exploration party to work out the geology of the region and to make the necessary survey for a detailed geological and mineral map.

Prospecting has also been carried on in other points of this region, and claims have been staked out in the townships of Baby, Laverlochère, Dasserat, Dalquier and others.

GRAPHITE

In 1910 the district of Buckingham was the only one in the Province of Quebec from which graphite was shipped. The shipments amounted to 309,400 lbs, representing a value of $15,896. This is an increase of $5557 as compared with the preceding year and it is the largest yearly production recorded to date.

For the purpose of comparison the following table presents the value of the annual production of graphite since 1898, compiled from the returns received by the Department of Colonization, Mines and Fisheries of the Province.

1910	$15,896
1909	10,339
1908	165
1907	5,000
1906	8,330
1905	no report
1904	2,300
1903	nil
1902	2,160
1901	4,690
1900	9,464
1899	14,257
1898	8,500

The beginnings of the graphite industry in the Province of Quebec date back a great many years. In the Geology of Canada, published in 1863, it is mentioned that a mine had been worked in Grenville previous to that year and that prospecting had been carried on extensively in Lochaber and Buckingham townships. Since then several mines have been opened, and mills erected in various places, but results have

not always been satisfactory; some of these have only been operated spasmodically, while others have been abandoned. The principal cause of failure seems to have been the difficulty of concentrating the graphite, which occurs disseminated in complex rocks.

The industry seems to be now on a more solid basis, and it is likely that the production will henceforth progress steadily.

The prices obtained for the Quebec graphite are satisfactory, and as the deposits are very large, the development depends on the successful means of concentration.

The "Mineral Industry" for 1909 gives the world's production of graphite as approximately 100,000 tons. The United States in 1909 produced only 2835 tons and imported 21,266 tons. The graphite produced in the United States is valued at an average of 6 cents a pound; the graphite imported into that country is valued at an average of 4½ cents. Canadian graphite produced in the Province of Quebec was quoted at 5 cents per pound according to the returns received from the producers.

The report of the Chief Inspector of Mines of Great Britain gives the following countries as contributors to the world's production of graphite in 1908.

	Metric tons	Value
Ceylon..	16,232	£ 531,572
Austria..	44,225	71,835
United States . .	2,347	
Italy..	2,914	14,765
India..	2,919	14,365
Bavaria..	4,844	12,372
Mexico..	1,580	5,849
Japan..	177	1,768
Canada..	228	1,143
Sweden..	66	421

According to Mr. Fritz Cirkel's monograph on graphite, published by the Federal Mines Branch, Ottawa, the quantity of carbon does not decide the actual value of a graphite The applicability of a graphite for the manufacture of crucibles in dependent upon the higher degree of cristallization, that is upon the larger or smaller quantity of graphite

scales or laminae. The graphite mined in the Province of Quebec is all of the crystalline variety and this no doubt accounts for the higher prices which it commands on the market.

GRAPHITE MINES IN THE PROVINCE OF QUEBEC

During 1910 only two mines were in actual operation in the Province of Quebec, viz: the Buckingham Graphite Co., and the Bell Graphite Co., both in the township of Buckingham. Other mines expect to be on the producing list in 1911, and a great deal of prospecting has been carried on.

Buckingham Graphite Co.

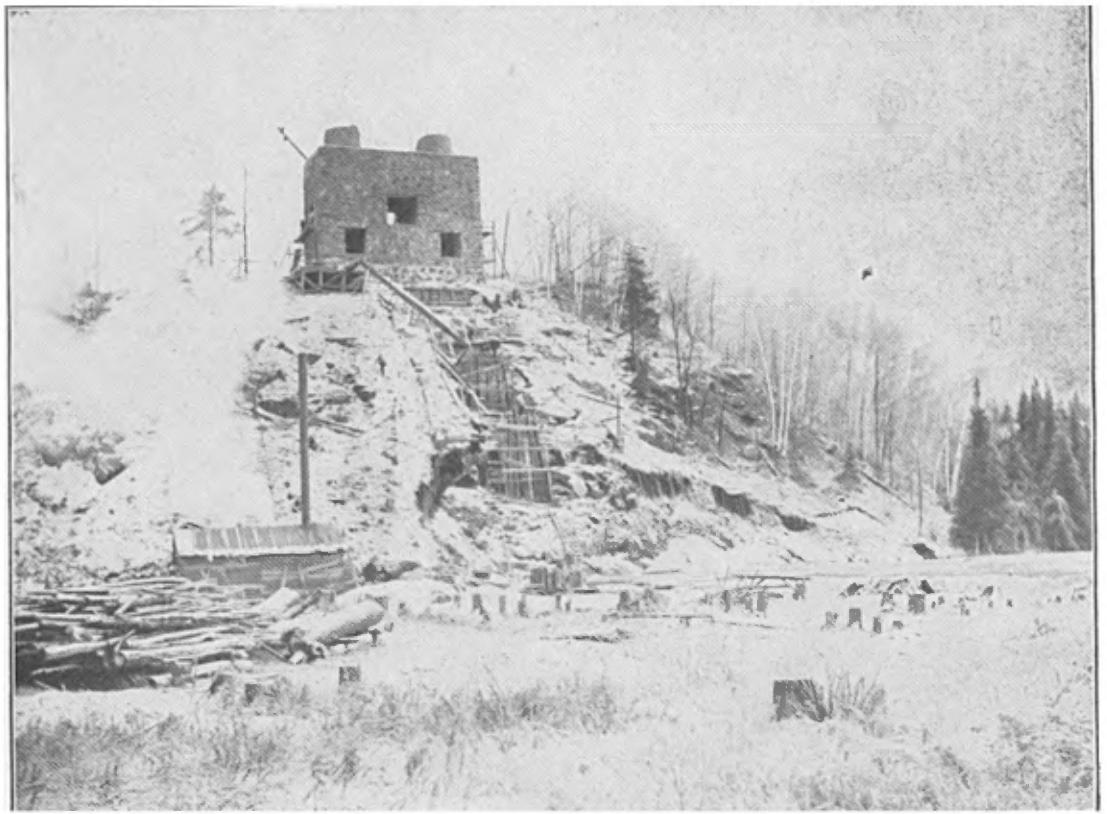
President, W. H. Hunter.

Manager, H. P. H. Brummel, Buckingham, P. Q.

This company which succeeded to the Anglo Canadian Graphite Co., owns lot 28, range VI, Buckingham Tp., and the workings are at present confined to this lot of 200 acres. The mill is erected on the northern part of the lot, near a creek from which the supply of water is derived. The building is 160 feet long by 60 feet wide. The ore is dried in a stone kiln near the mill, which is connected with the mine by a long trestle and tramway. The process of concentration in this mill is dry throughout. The ore is dumped into the kiln, wood being the fuel used, and it is next passed through a Blake crusher, screens and through a second crusher. The concentration is then effected by passing through a series of rolls, screens and bolts. The flake graphite then undergoes polishing in buhrstone mills. The milling plant has a daily capacity of 60 tons of ore yielding between 3 and 4 tons of finished products. Three qualities of graphite are produced, of which the highest quality is flake graphite, containing 96% pure graphite. This mill was in operation during the greater part of the year.

Workings have been opened in several places on this lot, the most extensive of which are in the immediate vicinity of the mill. At this place, in the side of a low hill, a tunnel has been driven towards the south for a distance of 300 feet. Two shafts have been sunk from the

GRAPHITE.—Dominion Graphite Co.—Foundation of new mill at Stewart Mine.



GRAPHITE.—Dominion Graphite Co.—Drying kilns in course of construction.

surface to the tunnel. The workings are in a hard bluish quartz rock which is much fissured, and which weathers to a rusty colour owing to the presence of iron pyrites. The graphite is disseminated through a sillimanite gneiss, in a belt or zone the width of which varies considerably and which reaches ten feet in places. The strike is south and the dip is 600 to the east.

Other workings have been opened a short distance to the south and all are connected by the tramway which runs mainly on a trestle. The latest of these workings consists in a pit measuring 50 feet N. W. and S. E., and 30 feet in the other direction. This excavation was full of water when seen but steps were being taken to pump it out. On the S. W. side of this pit a vein of disseminated graphite was observed, striking N. E., dipping 80° S. E. and about one foot wide. The hanging wall is a very dark micaceous gneiss, which passes into a hornblende and biotite gneiss. The contact between the graphitic zone and the gneisses is very sharp. The foot-wall is said to consist of a bluish quartz rock, similar to the rock through which the tunnel was driven. The pit is said to be 52 feet deep, and from the bottom a drift has been driven 42 feet to the east. At this depth the vein is said to have widened to 15 feet and to have yielded good ore.

The property is about eight miles from Buckingham, the road between these two points being comparatively good for hauling.

Bell Graphite Co.

Head office: Friar House, New Broad St, London, E. C.

Manager: Cosmo Kendall, Buckingham, P. Q.

This company owns lots 1, 2, 3, range V and lot 4, range X of Buckingham Township, but operations are at present restricted to the southern half of lot 2. The mill is erected about the center of the lot, on the south bank of McNaughton creek from which the supply of water is obtained. The property is situated four miles east of Buckingham.

The mill comprises two adjacent buildings, called

respectively the old and the new mill. The old mill being 65 feet long by 32, and the new one 80 by 35 feet. The boiler house and the engine house are 30 by 20 feet and 35 by 30 feet respectively. The power is supplied by two Davy-Paxman boilers of 200 H. P. each and a 200 H. P. engine.

The concentration of graphite is by dry process, except for the fines for which a wet process is used. The mill is connected with the mine by a trestle and tramway 100 feet long.

The ore is dumped into a Blake jaw crusher, then it goes through a finer crusher followed by a rotary drier. Concentration is effected by a series of rolls and screens.

Four grades of graphite are produced: No. 1 which is of high quality and three lower grades.

The southern part of the lot is a hill 200 feet high, in the side of which is the mine. The graphite ore is found in two bands or zones. On the first one of these zones, at 200 feet from the mill, a drift has been driven 185 feet long. At 150 feet a shaft has been sunk from the surface, 68 feet above the drift. The strike of the vein is S. 7° W, and according to the manager it has been traced for a distance of 2000 feet. with a few dikes intervening. In the present workings the graphite is disseminated in a gneiss and is accompanied by a white feldspatic rock. The general dip is 70°. The workable zone varies in width from very narrow to 15 feet. About 3000 tons of ore has been mined from the tunnel, carrying an average af 8% graphite.

From the workings on No. 1 vein a cross-cut is being driven to No. 2 vein, which is 30 feet to the east and parallel to the first one. This second band has the same characteristics as the No. 1 except that it is narrower. The foot-wall is a quartz rock and the hanging wall a rusty gneiss. The dip and strike of the country rock seem to be the same as the vein.

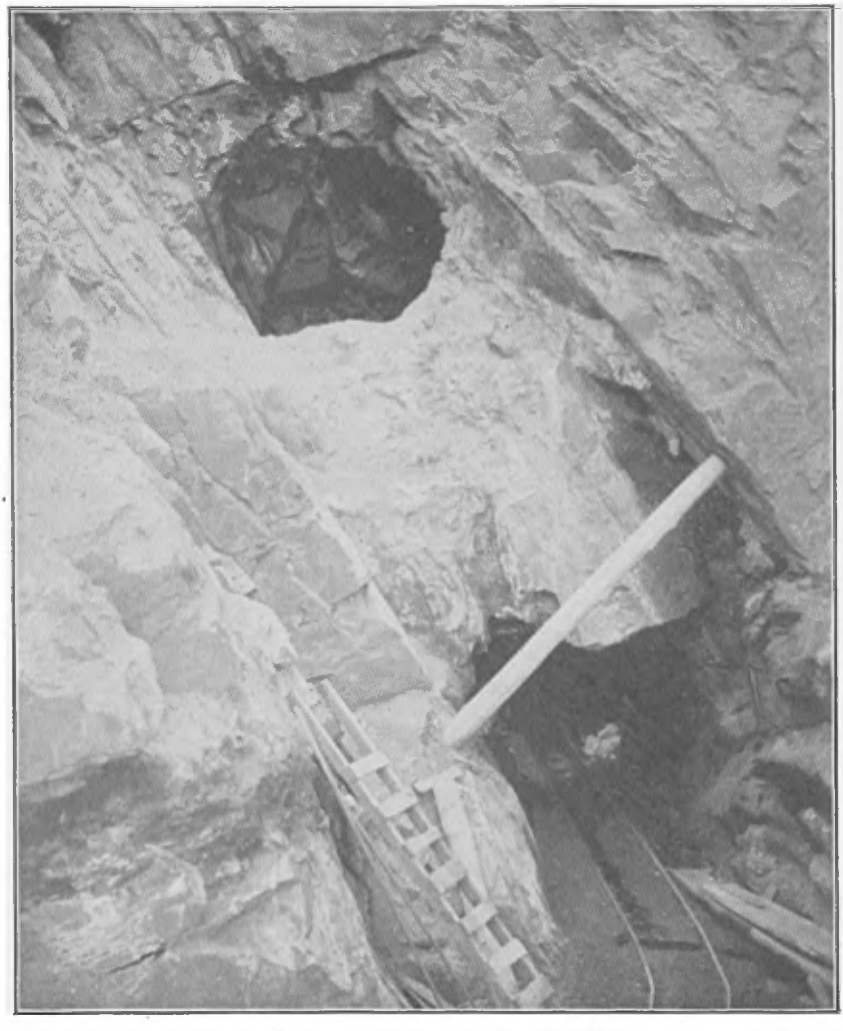
Peerless Graphite Company

Head office: Rochester, N. Y.

Mine Manager, H. W. Ham, Buckingham, P. Q.

This company owns lots 14b, 14c, ½S 13 and 12c, range

GRAPHITE.—Bell Graphite Co.—Concentrating plant.



GRAPHITE.—Tunnel at the Bell Mines.

X and N½ 11, range IX, of the township of Buckingham, formerly worked by the Diamond Graphite Co. The mill is built on N½ of lot 14 range X. The mill building is 78 by 42 feet and the adjoining boiler and engine house measures 27 by 70 feet. The drying kiln is built on a rise of the ground to the N. E. of the mill and the ore is sent from it to the mill by gravity.

The concentration process is dry throughout. The ore passes through a Jenckes jaw crusher, followed by two sets of rolls. It is then subjected to a series of rolling, screening and bolting. Three different grades are produced, No. 1 being crucible graphite. The mill has a daily capacity of 40 tons of ore.

Comparatively little mining work has been done on the lot on which the mill has been erected. There are only a few openings to the N. E. of the mill on graphite bearing outcrops in which the mineral is dissiminated in a rusty micaceous gneiss. These openings have been abandoned. The main supply of ore for the mill is from a deposit situated on lot 12, range IX, distant 1½ mile from the mill. The workings here consist of an opening 100 feet long, 70 feet deep, on a vein which may average a width of six feet. The graphite is disseminated in a feldspathic gneissic rock which yields 8% graphite in the mill. The ore is hauled by team from the mine to the mill.

The foot wall of this vein, which dips north at an angle of 70, is a micaceous gneiss, grey in colour, cut by veins of coarsely crystalline feldspar and quartz. The contact between the wall and the vein is usually sharp, but in places a gradation from one to the other is noted. Prospecting has been carried on in other places on this lot, notably at 600 feet east of the main pit, where stripping has uncovered workable graphite.

Dominion Graphite Company

(Stewart Mine)

Head office: Toronto, Ont.

Manager, H. P. H. Brummel, Buckingham, P. Q.

This company owns lots 20 and 21 in range V of Buckingham township. A mill is being completed on cadastral

lot 21c and this plant will be the largest and most up to date of the district. Power will be generated by three boilers of 180 H.P. each, supplying steam to a 450 H.P. engine and to two smaller ones used for lighting and for hoisting. The ore will be brought to the mill in cars hauled by a steam locomotive. At the mine itself two boilers will supply power for the derricks and for ten steam drills. . The mill is designed to treat 200 tons of ore a day. The plant comprises the following buildings. Main mill building 120 by 42 feet, 64 feet high, three stories. Building on hill side, 250 feet by 25. Boiler house 36 by 86 feet, and annex. Two drying kilns on hill side. Boarding house, office building, store houses, etc.

The main deposit is on the line between lots 20 and 21, on a hill 500 feet north of the mill. The workings comprise an open cut on the hill side, about 100 feet long by 10 feet wide. This band follows a graphitic bed of high grade. The mineral is disseminated in coarse flakes in gneiss which is much decomposed and rusty near the surface. At the end of the cut the graphite band appears to fork and on the north-east branch further prospecting has been done, showing a band of disseminated graphite 5 to 6 feet wide, dipping N. W. at an angle of 45. The graphitic band rests on a bluish quartz rock followed by a fine grained feldspathic rock. In the first cut several pegmatite and diorite dykes cut the formation, the latter being the more recent.

Graphite Limited

Mine at St. Rémi d'Amherst. A. M. Griffin, Manager.

This company has done considerable prospecting work on lots 17, 18, 19, 20, 21 range VIII and on part of 13 and 14 of the same range in the township of Amherst.

A shaft 92 feet deep has been sunk and considerable open-cutting and stripping has been done in the vicinity. It is said that good concentrating ore has been exposed. The plant comprises a 80 HP. boiler, a compressor, drills, and a boarding house for the men.

GRAPHITE.—Buckingham Graphite Co.—Tramway and Mill.

MICA

There has been a marked increase in the shipments of mica as compared with 1909. The value this year amounted to $58,668 against $27,034 for the preceding year. It must be said however that a large proportion of these shipments were made from stocks on hand, and the returns received at this office indicate that the prices ruling for mica during 1910 were not sufficiently improved to notably stimulate the output of the mines. At the end of the year there was still a large quantity of stocks.

Twenty-eight returns were received from mica operators out of which thirteen reported shipments.

The production of mica in the Province of Quebec is centered in Ottawa county, mainly in the townships of Templeton and Portland. The varieties mined are the phlogopite and biotite, used mainly in the construction of electrical apparatus.

This industry is very irregular and the figures of production are liable to vary considerably from year to year, as the following table will show.

VALUE OF MICA PRODUCTION SINCE 1899

Year	Value	Year	Value
1899	$136,863.00	1905	95,460.00
1900	163,600.00	1906	168,887.00
1901	39,600.00	1907	223,878.00
1902	34,304.00	1908	95,311.00
1903	74,119.00	1909	27,034.00
1904	85,024.00	1910	58,668.00

India is by far the largest contributor to the world's supply of mica. Their yearly production is about $750,000 and owing to the abundant and cheap labour available in that country, it practically controls the market. A large proportion of the Indian mica is exported to the United States and England, where it comes in competition with the Canadian Mica.

The annual imports of the United States amount to $500,000.

CHROME

During the year 1910, the Chromite industry of the Eastern townships was practically at a stand-still. The chromite deposits of the serpentine belt of the Eastern Townships are, in the main, concentrating propositions, although some ore, after sorting at the mine, can be shipped crude. At the rates of $14 to $15 per long ton quoted ex ship, New-York for 50% New Caledonia ore, the margin of profit on the Canadian ore is too small to make it attractive.

Returns of producers show that 299 tons, valued at $3734 were shipped during the year. These shipments were made altogether from old stock-piles.

Besides Canada, the world's sources of chromite are in the following countries, in order of importance: New Caledonia, Turkey, Russia, India, Portugese East Africa.

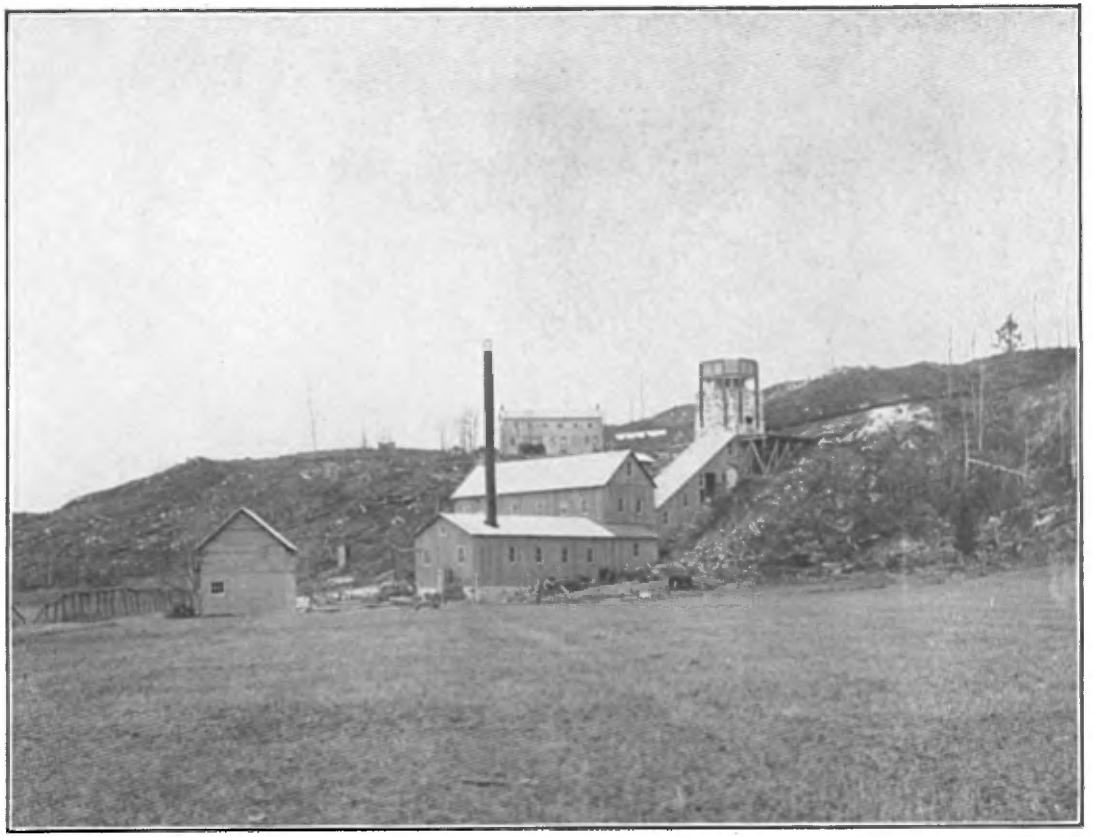
PEAT

During 1910 operations for the production of peat were carried on at Farnham in the county of Missisquoi, by the Canada Fertilizer Company, with an Anrep peat machine. Several hundred tons of peat fuel are said to have been produced, part of which was disposed of locally. This plant and the bog have lately been acquired by a new company, "Peat Industries, Limited" with head-office in the Imperial Bank Chambers, Montreal.

Although the Province of Quebec is not favoured with coal deposits, peat bogs abound, which will eventually make up largely for the lack of fossil fuel in the Province.

Several attempts have been made to work up a peat industry in this Province, which have not so far met with success, but the failures can in almost every case be traced to causes quite irrespective of the value of our peat deposits. Of these causes may be mentioned: Lack of judgment in the choice of bogs, adoption of methods of working unsuited to economic results, lack of management, unfamiliarity with past experience and failures, etc.

Realizing the importance of the establishment of a peat



GRAPHITE.—Peerless Graphite Co.—Kiln and concentrating plant.

industry in the middle provinces of Canada which have to depend on coal from the United States for fuel for both industrial and domestic consumption, the Mines Branch of the Department of Mines of Canada has undertaken an investigation and an educational campaign on the utilization of peat. This led to the purchase, by the Mines Branch, of a peat bog at Alfred, Ontario, on the line of Canadian Pacific Railway, between Montreal and Ottawa, on which is established a full size peat-fuel plant, which after a successful campaign in 1910, has demonstrated the praticability of the economic utilization of peat.

"The investigation has demonstrated that:

1st.—For economic production of fuel from peat, machinery driven by power must be substituted, as far as possible, for manual labour.

2nd.—The processes so far invented for removing the water content of the peat by pressure and artificial heat have not led to commercial results and after trial have been abandoned in favour of air-drying methods". *

The Mines Branch have also erected in Ottawa a gas-producer plant, using peat for power purposes, to demonstrate the practical use of peat industrially. The producer has been successfully operated and interesting tests have been conducted, which prove that peat can readily be used on a large scale for power purposes.

The Government peat plant at Alfred, in 1910, produced peat at the following cost per ton, including interest on capital invested, amortization, oil, repairs, etc.:

Cost of fuel on the field	$1.40
" " " stored in shed . . .	1.65
" " " on car	1.65
" " " in stock	1.70

Considerable further economy could probably be effected and it is likely that peat will be produced at much lower costs as the industry develops and expands.

As to the calorific value of this peat it may be said

* Dr Haanel's presidential address American Peat Society 1910.

that roughly speaking one ton of the best coal is equal to 1.8 tons of peat.

Peat does not stand transportation to great distances without appreciably desintegrating and therefore deteriorating. For power purposes the most rational method of utilizing it is by erecting power plants at the bog, for generating electrical power, which can be transmitted advantageously to great distances.

In Europe peat is now produced in Scandinavia, Russia and in Germany on a large scale, and as the quality of many of our peat bogs leaves nothing to be desired, it is not improbable that the industry may before long be established on a firm basis in Quebec and in Ontario.

Large areas of peat bogs occur in various places in the Province of Quebec. The following list of localities, where peat has been observed to occur in workable quantities, is taken from a bulletin on the subject published by the Geological Survey a few years ago:

Anticosti Island; New Carlisle in Bonaventure county; St-Eloi and Isle Verte; Cacouna Station; Rivière du Loup; Ste-Hélène Station; Rivière Ouelle; Ste-Catherine; Cap Santé; Chaudière Station; Craig's Road; Lyster and Kingsbury Junction; Black Lake; St-Francis Lake; Aylmer Lake; Bulstrode Tp in Arthabaska County; Farnham; near St-Célestin; near Waterloo; Ste-Brigitte in Rouville County; Hemmingford; Missisquoi Bay; St-Dominique; Longueil; Grenville Tp. near the Ottawa River; St-Janvier; St-Jérôme; Ste-Anne des Plaines; St-Sulpice; L'Assomption; Lavaltrie; Lanoraie; Les Grès on St-Maurice River; Garneau Junction; on Champlain River.

The above list is only a partial one. Large areas occur in more or less remote parts of the country, which are too far from settled districts to be of much economic interest at present.

NATURAL GAS

In 1906 and 1907 a company, "The Canadian Gas and Oil Company" bored several wells in the vicinity of Louiseville and Yamachiche in Maskinongé and St. Maurice coun-

ties. A supposedly satisfactory supply of gas was struck at 225 to 300 feet in the superficial deposits near the solid rock. Lines of pipe were laid down to supply these towns and in 1907 another line of 8" pipe, 13 miles long was laid down to supply the city of Three Rivers.

In his report for the year 1907, the Superintendent of Mines, Mr. Obalski, commenting on this undertaking gave the following opinion:

"As to the duration of this supply of gas, everybody knows that it is surface gas, and I estimate that in order to find more lasting reservoirs it will be necessary to bore deeper into the rock, and locate the wells towards the south."

This prediction was well borne out. The supply lasted only a few months and for over two years it has been practically exhausted. Since then further boring operations have been undertaken in this district, but without satisfactory results.

In this connection we may quote the opinion of Dr. Selwyn, late director of the Geological Survey who in the Summary report for the year 1887 expresses himself as follows:—

"An all-important consideration in connection with the probable occurrence of these reservoirs of gas and oil is that of the geological structure of the district; and while for reasons in connection with this I have never had any faith in their occurrence on the north side of the St. Lawrence, I consider that the probability of such reservoirs existing on the south side, in the country between Lake St-Peter and St-Hyacinthe is very great, especially along or in proximity to the central part of the line indicated by Sir W. E. Logan as the course of the Deschambault anticlinal."

In 1885 a local company was formed to bore for gas and oil at St. Grégoire in Nicolet county. A well was put down to a depth of 1115 feet on the property of H. Trudel, No. 501 cadastre, and strong flows of gas were struck at various depths.

In the report of the Commissioner of the Crown lands for 1885, Mr. Obalski mentions that he estimates the flow of gas of this well at 250,000 cubic feet in 24 hours. In the

report for 1887 mention is made that the well was still flowing at that time.

Referring to this well Dr. Selwyn in the Summary report of the Geological Survey for 1887 states:—

"This boring has evidently passed through the Medina shales and sandstones which appear to be here 565 feet thick and the remainder of the boring, 540 feet seems to be in the Hudson River rocks. Below these the Utica, and the Trenton would be found and as it is at the junction of the latter that the main gas and petroleum occurs in north-western Ohio it seems very desirable that the St. Grégoire boring should be continued till it reaches the Trenton limestone. The Ohio section shows the Medina only 80 feet thick with 305 feet of Clinton and Niagara on top, and at the base of the Medina there is a heavy flow of gas as is the case at 640 feet of Hudson River strata and 275 feet of Utica shale, at the base of which, or a few feet lower in the Trenton limestone are, as above stated, the great petroleum and gas reservoirs."

After lying dormant for a number of years the question of the presence of gas in the region south of the St. Lawrence river was reopened during 1910.

On the indication of gas bubbling in an old well which had been dug years ago, a local syndicate was formed at St. Barnabé in the county of St. Hyacinthe, and a well was bored on the farm of Mr. Joseph Fontaine, St. Amable, range north, cadastral division 164, some six miles north-east of the town of St. Hyacinthe. The well was begun on April 1st 1910 and stopped on July 14th at a depth of 1880 feet. At the depth of 1860 feet a strong flow of gas was struck. The boring was continued 20 feet further, and the well capped and closed.

The "rock-pressure" was measured by an officer of the Mines Branch on November 10th by means of a steam gauge, which was subsequently compared with a standardized one. The actual pressure was 275 lbs per square inch.

It was not possible to obtain an accurate log of the well drilled, but from enquiries it would appear to be somewhat as follows:—

0 to 125 feet.. .. ..surface deposits
125 to 900 feet.. .. ..reddish shales slightly calcareous
900 to 1860 feet.. .. ..dark gray shales, calcareous
1860 to 1865 feet.. .. ..harder rock, gas bearing
1865 ta 1880 feet.. .. ..dark shaly rock, not gas bearing.

From this log it would appear as though the drill had gone through the Medina strata, if present, and through the underlying Hudson River, reaching the gas-bearing horizon at the base of the latter, near its contact with the Utica.

If such be the case the Trenton Limestone has not been struck, but would be encountered some 200 feet lower down. As the Trenton is the most likely source of a reliable and lasting supply of gas, this would be an important point to investigate.

On the other hand, it is quite possible, according to the opinion of some members of the Ottawa Geological Survey, that the upper part of the Trenton at this point is represented by shaly rocks instead of by more massive limestone as in vicinity of Montreal. In that case the boring would have penetrated some 20 feet into the Trenton.

Only a test by boring could solve this question, and it is hoped that an effort will be made to further prove the region, as the results obtained in this well would fully justify further active search both in depth and as to area occupied by the gas bearing horizons.

BUILDING MATERIALS

A comparison of the figures of production for 1910 with those for the preceding year shows very large increases for the various building materials and clay products. As compared with 1909, the figures for brick show an increase of 55% ; lime has more than doubled ; granite has increased 90% ; marble 16% ; lime stone 10% ; Cement 48%.

It must be said that previous to 1909 the figures of production of structural materials were based on data collected in the course of the decenal census, so that for the intermediate years they were mere estimations. For the last two

years, the statistics have been obtained direct from the producers and the large increases of 1910 over 1909 are in a measure due to more complete returns being received at the office of the Mines Branch; but on the other hand there is no doubt that in the last few years the building activity throughout the whole province, and more particularly in the large centers of population, has very much increased.

CEMENT.—Cement was manufactured by the Canada Cement Company in their three plants situated respectively at Longue Pointe, at Pointe aux Trembles, both on the island of Montreal and at Hull, Ottawa county. The quantity of cement sold and shipped from these plants in 1910 totalled 1,563,717 barrels valued at $1,994,646 or an average of $1.25 per barrel, as against 1,011,194 barrels, valued at $1,314,551 in 1909, or an average price of $1.30 per barrel.

The following table gives a better idea of the astounding growth of the Portland Cement Industry in the province of Quebec, than lengthy statements on the subject.

ANNUAL PRODUCTION OF PORTLAND CEMENT IN THE PROVINCE OF QUEBEC

Year	Quantity, Barrels	Value
1904	33,500	$ 50,250
1905	254,833	408,000
1906	406,103	625,570
1907		640,000
1908	801,695	1,127,335
1909	1,011,194	1,314,551
1910	1,563,717	1,954,646

The capacity of the three cement plants in the province, with their present equipment is 7,000 barrels a day, or approximately 2¼ million barrels a year. The present plants will therefore suffice for some time to come, as last year there was a margin of 600,000 barrels between the capacity and the output.

MARBLE.—The Philipsburg quarry of the Missisquoi Marble Company was operated very actively during 1910, and their production considerably increased. A new company, the Dominion Quarry Company started operations on a very promising marble deposit, situated on lot 8, range II of South Stukely. The marble obtained here is white with green and reddish colouring. Very active development work was carried on during all summer of 1910 and although the shipments for the year were small and more of a tentative nature, the results have been so satistisfactory that a railway spur has been built to the quarry which is now being equipped with modern machinery.

Some work was also done on a marble deposit in Beauce county on the Colway river, but this was only of a prospecting nature.

SANDSTONE.—It is very interesting to note that a sandstone quarry has been opened last year by Mr. Ed. Wright of Haileybury, on lots 18, 19 and 20 of range I Guigues Township, on the shore of lake Temiskaming, almost opposite the town of Haileybury. This sandstone on fresh faces is soft, but hardens quickly on short exposure to the air. It is in even beds, with a slight dip towards the lake, and is very easily quarried. Its colour is a fine warm buff. It dresses easily and is of a very even texture. The work done during 1910 was of a prospecting nature, but the results are said to have been very satisfactory. This sandstone forms a narrow fringe along the lake, from Piché point northward, for a distance of about three miles. It belongs probably to the Niagara formation which here rests directly on the Pre-Cambrian.

FELDSPAR.—The feldspar group of minerals comprises a great number of species of silicates, composed of alumina and silica with one or more of the bases, potash, soda, lime. They fall into two main divisions, the potash feldspars and the lime-soda feldspars.

Of the first division, the most common representatives are orthoclase and microcline. The second division forms a long series beginning at one end with Albite, a soda felds-

par, and terminating at the other extremity with anorthite a lime feldspar. Between these extremes are a great many intermediate members. From the commercial standpoint the potash feldspars are the important ones and they constitute the great bulk of the feldspar mines in United States and Canada.

Feldspar of commerce is obtained from the pegmatite veins or masses, which are in reality granites of an extremely coarse texture, some single crystals weighing several tons. The principal uses of feldspar are in the manufacture of pottery and enamelware. The potters demand that feldspar be nearly free from iron-bearing minerals. The grading usually adopted by consumers is as follows :—

No 1.—Free from iron-bearing minerals, and containing less than 5% quartz, price f. o. b. at mills, crude, per long ton $4.50 to $5.50.

No 2 or Standard—Largely free from iron-bearing minerals and containing 20 per cent quartz, $3.50 per ton.

No 3.—Below Standard grade in contents of iron bearing minerals and quartz $2 to $3 per ton.

Besides these grades there is a small demand for a very high quality of potash feldspar called 'dental spar', used in the manufacture of artificial teeth, which sells as high as $35 and $40 a ton.

There are in the province of Quebec numerous deposits of feldspar, this mineral occuring as a constituent of pegmatite dykes in the Archoean areas. It has been mined at half a mile West of Templeton station, north of the Canadian Pacific Railway; at the Villeneuve mine, in Villeneuve Township, Labelle county; on the road from Gatineau point, six miles from the railway.

Moreover, workable occurrences are known near Papineauville; on Calumet Island; and on the north shore of the Lower St-Lawrence in the Mingan Seigniory near Washeeshoo river, where it is said that there are numerous pegmatite dykes very coarsely cristalline which could yield thousands of tons of a pure high grade and standard grade potash feldspar. The feldspar could be mined

above the level of the tide water, and it is believed that vessels of ordinary draught could easily be loaded.

Several inquiries have been received at this office during the year concerning feldspar as a source of potash.

As is well known, Germany has practically the control of the world's supply of potash salts, from the celebrated Hanover Mines. The action of Germany in imposing a heavy export duty on the products of these mines, has induced consumers in the United States and Canada to turn their attention to other sources of supply, and as pure orthoclase contains nearly 17% of potash it is natural that it should receive consideration in this connection.

KAOLIN.— Some exploratory work was done on the kaolin deposit which occurs in Amherst township on parts of lots 4 to 8 range VI. Two tons are said to have been shipped to various pottery manufacturers for experimental purposes.

THE OPASATICA DISTRICT

Geological and Mineralogical Notes—(By Robert Harvie.)

INTRODUCTION

In view of a renewal of prospecting activity, Mr. Robert Harvie was directed to make a brief examination of the Lake Opasatica gold discoveries. A comparatively short time only was spent in this examination, and the following necessarily brief report is based on this work, further supplemented by information as to the general geology of the district obtained from the summary report on "Lake Opasatica and the Height of Land" by Morley E. Wilson (*).

POSITION OF THE AREA

The geologically most favorable portion of the district has been found to be an area of ten square miles, near the height of land, around the north end of Lake Opasatica. The rocks of this area extend in a belt westward, past the north side of Larder Lake, where gold is found to be rather widely distributed. The first discoveries were made beside two small lakes, (Fortune and Reneault), three miles north-east of McDonald's trading post, at the north end of Lake Opasatica: or about forty-five miles in a direction slightly east of the north end of Lake Timiskaming.

MEANS OF ACCESS

McDonald's, whence there is a waggon road to the discoveries, may be reached by the following four routes. North Temiscaming and Ville Marie on the east shore of Lake Timiscaming are the two important starting points, and may be reached by steamboat from Haileybury on the Temiscaming and Northern Ontario Railway, or from Temiscaming Station on the Canadian Pacific Railway, Mattawa branch.

From North Temiscaming, the south end of Lake Opasa-

(*) Summary Report 1908, Geological Survey of Canada, p. 121.

tica may be reached by a road twenty-four miles long, of which at present the last ten miles are only fit for winter travel. Lake Opasatica is navigable for small power boats to McDonald's, a distance of twenty-two miles. When the road has been prepared for summer traffic, this will be the best route of any.

From North Temiscamingue another waggon road of sixteen miles goes to Klock's Depot on lac des Quinze. The Barrière portage, ten miles from Klock's is a quarter of a mile long, after which there is smooth water for forty miles to McDonald's, by way of Lac Barrière, the Lonely River and Lake Opasatica, all the waters being navigable.

From Ville-Marie, Gillies' Depot on lac des Quinze may be reached by a waggon road, which though longer (23 miles) is much better than to Klock's, from North Temiscaming. Gillies' is fifteen miles by water from Klock's, whence the route is the same as described for the last, these two roads being the only ones at present available in summer.

From Dane Station, on the Temiscaming and Northern Ontario Railway, the Ontario Government have built a good waggon road to Larder City, (18 miles) whence there is twenty-two miles more of winter road to McDonald's.

The writer was informed that during the summer of 1910, freight from North Temiscaming to McDonald's cost about twenty cents per lb. In winter this charge should be reduced to one quarter, judging from rates to the Transcontinental Railway caches in this same district.

TOPOGRAPHY

The country about the main body of Lake Opasatica has very moderate relief, and particularly on the east side, where there is an extensive area of clay lands, exposures of rock are neither frequent nor extensive. In contrast to this, the north end of the lake enters the southern margin of an east and west lying belt of Huronian sediments, marking the divide between Ottawa and Abitibi waters, where there is relatively great relief, and exposures are abundant and good. Of the hills into which this belt has been broken, the higher points are so noteworthy as to have been given special names, such as Shiminis, the Swinging and Kekek hills. These have maximum elevations of from 500 to 700 feet above the

surrounding country, and are chiefly made up of Huronian quartzites and conglomerates, but with extensive exposures of the Keewatin rocks on the lower slopes. The area under discussion lies in this belt amongst these hills.

GENERAL GEOLOGY

The same varieties of rocks are found here and elsewhere in the adjacent districts of Quebec and Ontario. Arranged in descending order the succession of the formations is as follows:

PLEISTOCENE

Post-glacial.. .. ..clay and sand.
Glacial.. .. ..boulder clay, gravel and sand.
(Unconformity)

PRECAMBRIAN

Post-Huronian.....diabase, gabro, porphyry.
(Igneous contact)

Huronian.....quartzite, slate, greywacke, conglomerate, breccia.
(Unconformity)

Laurentian.....granite, gneiss, pegmatite, aplite.
(Igneous contact)

Keewatin.....Mica schist, greenstone, green schist, rusty weathering carbonate rock, quartz porphyry and porphyrite.

The Keewatin comprises a group of rocks chiefly igneous, whose interrelations are generally so much obscured as to render very difficult the identification of their true original character. In general they have been much squeezed; thus rocks which may once have been diabase or diorites, after flowing under pressure, have become schistose and are now represented by green stone or green schists. This schistosity, though not always present, is so pronounced as to be a distinguishing feature of the Keewatin in contrast to somewhat similarly colored rocks of the Huronian.

Mica schist:— A large area south of the height of land, and extending from Opasatica to the east, past the Kinojevis

river is occupied by mica schists. They are characterized by good cleavage, and a general grey color, due to being an interlamination of white quartz and brown mica.

Rusty Weathering Carbonate Rock :—* In the neighbourhood of Larder Lake, and north of lake Opasatica, are local outcrops and bands of a rusty weathering rock, consisting of ferruginous dolomite or ankerite, with varying quantities of quartz and felspar. It is always highly pyritic, and in most localities contains a large amount of chrome-mica or fuchsite, from which the rock derives its characteristic green color. As a rule the rock is cut in a most complex manner by two or more sets of veinlets consisting of quartz or of quartz and ferruginous dolomite."

The gold values at Larder seem to be closely connected with this carbonate rock, and a similar rock is reported to be closely associated with the gold occurrence at Porcupine and Abitibi also. **

The Larder Lake mica, besides containing chromium, also tests readily for lithium, two unusual and distinctive elements, and presumably both present in the fuchsite. A similar green mica, described under the name mariposite, is a common vein mineral in the gold mines of the famous Mother Lode district in California. *** The exact nature of the carbonate rock is not yet known, but the evidence seems to point to its being derived from the decomposition of serpentine. In the case of the Abitibi occurrence a chromiferous peridotite is found a very short distance away, and the presence of chromium in the carbonate rock also, suggests a relation between the two.

Quartz porphyry and porphyrites.—Areas and dykes of intrusive quartz porphyry and porphyrites are found in the district. At times they are distinct and large enough to be mapped separately, then again, they are so intimately intermingled with the greenstone that they do not allow of any exact separation.

Laurentian :—The Keewatin is intruded by a biotite

(*) See M. E. Wilson's Summary Reports; Geol. Survey of Canada 1908 and 1909.

(**) Ontario Bureau Mines, 18th Report, p. 270.

(***) F. L. Ransome, folio 63 U. S. Geol. Survay.

gneiss or granite with its accompanying dykes of aplite and pegmatite, all known as the Laurentian. The pegmatite grades into veins of almost pure quartz, and at several places on Lake Opasatica, these attractive looking veins have drawn the attention of prospectors. This class of veins contains molybdenite in the vicinity of Lake Keewagama, about fifty miles to the east, but they seem to be valueless at Opasatica. Careful search will generally show them to contain crystals of pyroxene or felspar, by which fact they may be distinguished from the gold bearing veins cutting the Keewatin porphyrites.

Huronian:—The Huronian rests on an irregular surface of the Keewatin and Laurentian rocks just mentioned. It presents nearly the same succession of rocks,—conglomerate, greywacke and arkose, as the Lower Huronian of the Cobalt district. The one great difference is that the basal conglomerate rests on a formation of a volcanic tuff or breccia. As far as could be learned in a hurried examination, the succession between Fortune and Reneault lakes consists of schistose Keewatin quartz porphyry and porphyrite, overlain by a non-schistose breccia, which grades upwards, by the addition of rounded pebbles, into a conglomerate. Across lake Reneault to the south, the normal Huronian is found. Although the relations to the other Huronian rocks are not clearly established, the evidence of lack of schistosity alone, seems sufficient to warrant classing this rock as Huronian. The breccia consists of angular fragments of a basic glassy rock cemented by glass. A rusty weathering, much decomposed, dyke of apparently a diorite rock, cuts the breccia, and is itself cut by quartz-ankerite veins carrying gold and petzite. These veins are thus Huronian or later in age, corresponding with those of the Porcupine district.*

Post-Huronian:— Diabase and gabbro dykes are found at a number of points cutting Keewatin, Laurentian and Huronian rocks. A dyke of porphyry is described by Wilson as cutting the Huronian between Olier and Reneault lakes. These are evidently comparable with the diabase and gabbro rocks of the Cobalt and

(*)See note by W. G. Miller on Map of the Porcupine Gold area —XIXth report. Ont. Bur. of Mines 1910.

Montreal River districts. The diorite dyke cutting the breccia is also Post-Huronian.

ECONOMIC GEOLOGY

Gold was first discovered on the property now owned by the Pontiac and Abitibi Mining Company, and to date the only development work of any consequence in the district has been done on their claim.

One pit having a depth of thirty feet, six of about ten feet, besides other still smaller workings, was the state of progress at the time of the visit (September 1910) and the study of the deposits has thus been very limited.

The gold is associated with quartz-ankerite veins cutting the Keewatin porphyrite, and the Huronian breccia and associated dyke. The largest vein seen averages about two and a half feet wide in an exposure of one chain in length, and it may be said that all of them seem to hold their width well. During the examination only one specimen was found having visible gold, but comparison of this with material collected by others from various veins, showed it to be quite representative. The quartz is partly massive, partly in free crystals, in both cases being commonly banded with ankerite and carrying sericite, iron pyrites and copper pyrites. The gold occurs both free and in combination with silver as the telluride *petzite* *, in which mineral there is 25½% of gold and 42% of silver. The petzite was introduced later than the quartz and ankerite, being found in fractures in these minerals. The gold is chiefly in seams in the petzite.

Apparently here also, as has been found to be the case in other districts, the telluride has precipitated the gold, but the evidence yet obtained is too scanty to warrant saying whether or not this is a secondary enriched zone. At Cripple Creek, Colorado, in the zone of oxidation above the level of the ground water, the gold occurs free, having been left from the leaching of tellurides. Below ground water level, the tellurides have not been leached, and not only do they still contain their original

(*) In a note published by the Quebec Mines Branch, the telluride was given as sylvanite : Further determinations proved it to be petzite.

gold content, but in addition they have caught and retained any free gold passing down in solutions from the zone of oxidation, thus causing an important secondary enrichment. The presence of tellurides at the surface, at Opasatica, indicates that the zone of oxidation has been removed by the heavy glaciation to which the district has been subjected. The present surface must therefore come either at the level of the zone of enrichment or below, but in either case, from this argument, it seems unwarranted to expect any great increase of values with depth, such as is regularly found to be the case in the mines of the Western States.

In one instance copper pyrites forms a large part of the vein matter, and the wall rock on either side is also heavily charged with sulphides, probably chiefly iron pyrites. An assay of the pure copper pyrites showed only half an ounce of silver and a trace of gold per ton; the wall rock gave only 40 cents gold per ton; apparently then, both these are unimportant as carriers of values.

The accounts so far published show that the geology of the Porcupine district is essentially similar to that of Opasatica, more especially the gold occurs in similar quartz-ankerite veins. Tellurides have not been reported as yet from Porcupine but it has been reported that some apparently unpromising veins have yielded good assay values, which values may well be due to the presence of tellurides. In other veins the free gold at the surface has been found to continue in slightly increasing quantity down to depths of two hundred feet. If this represents the zone of oxidation, then an enriched zone may be expected not far beneath.

SUMMARY

Summing up all the factors that seem to have any bearing on the subject, the following points may be enumerated as being specially important to those prospecting in the Opasatica area.

The gold bearing veins need not be confused with the Laurentian veins. Careful search will usually show the presence of molybdenite, felspar or pyroxene in the Laurentian. The gold bearing veins usually have abundant

ankerite, a mineral which closely resembles cloudy calcite when fresh, but when weathered gives a residue of iron rust. Ankerite is moreover appreciably harder to scratch than calcite.

The quartz-ankerite veins should be carefully examined for petzite, which contains a large percentage, of gold in its composition. Petzite has a high metallic lustre of a steel colour, is very easily scratched and altogether closely resembles galena, except that it lacks cleavage, and hence does not break into the cubes so characteristic of the latter.

When free gold is present it will usually be found with the telluride if that mineral is also present. The full value of the gold present cannot be judged from inspection or even by panning, because the amount contained in the petzite is not shown by either of these processes. For this reason it is very essential that ores should always be tested by fire assay. Similarly when installing a plant for the treatment of these ores, it must be kept in mind that simple amalgation or cyanidation will not recover the gold and silver values of the tellurides. The ore has to be thoroughly roasted before employing these processes.

GEOLOGICAL RECONNAISSANCE IN THE GASPE DISTRICT *

(By A. Mailhiot)

In order to obtain further data concerning the geology of certain parts of the Gaspé Peninsula, observations were made in the immediate vicinity of certain streams.

York River and Ste-Anne River were ascended to their heads, and in the course of our explorations we endeavoured to work out, as accurately as possible, the relations between the rocks which constitute the Notre-Dame or Shickshock mountains and those of the Levis formation. We also determined the outlines of the Silurian and the Devonian rocks which underlie the central and southern parts of the Gaspé peninsula.

I did this work as geologist, attached to a party under the leadership of Mr. J. T. Bertrand, Public Works engineer in charge of the Gaspé district, who had as assistants MM. M. Beauset and C. E. Pouliot. The object of this exploration was to study the natural resources of the country and to do some river gauging.

The party reached Gaspé Basin at the beginning of July, where preparations were made for the season's work. While there, we obtained all possible information concerning the nature of the country and of the streams of the region, more especially of the York River. We engaged eight guides with four canoes for the trip.

York River

We left Gaspé on July 11th for the upper reaches of the York River. At its mouth this stream is about one mile wide; five miles higher up the width decreases to a few hundred feet. The tide is noticeable for a distance of seven miles from the mouth.

After two days paddling, we reached a point called the Narrows, where we had to land and to portage for a distance of eight miles. At two points in this distance, the river measures two feet and ten inches in width, respectively.

(*) Translated from the French.

These points are six miles apart. The river at these places flows in an underground channel, hence the designation "The Narrows".

Above the Narrows, the river is very swift and crooked; severals rapids are encountered having a fall of 4 and 5 feet. The average fall of the river is twenty feet per mile.

At a short distance from its head the river forks into two branches, one flowing from the west, the other from the north. We ascended the north branch. Above the forks the water is very shallow and we had great difficulty in poling up. After having wormed our way through the numerous windfalls which obstruct the stream in many places, we reached the first lake, which is ten miles above the forks; our progress was very slow owing to the obstructions which necessitated numerous portages.

From aneroid barometer readings, the first lake is 1500 feet above sea level ; it is about 80 miles from the coast, which gives an average fall of 19 feet per mile. This lake is almost circular in outline, its diameter being about one mile.

Five miles higher up there is another lake, of greater size which is about four miles long and one mile wide.

We reached this latter lake on July 21st. This sheet of water is entirely surrounded by hills. We spent five days in exploring these hills and the region towards the head-waters of the Madeleine river. The chief eminence in the district is Porcupine Mountain, on the west side of the lake; it has an elevation of 1000 feet above the lake.

The region which is drained by the lower part of the York river is known as the Gaspé Oil Region. Its geology has been worked out by Dr R. W. Ells of the Geological Survey, whose report was published in 1903. It is a broken country of low hills with elevations varying between 300 and 500 feet above the river. Along the shores are considerable areas of good land. The timber consists mainly of black spruce, sometimes mixed with birch, white spruce and cedar. Lumbering operations have been carried on for a distance of fifteen miles from Gaspé.

Ascending the river the general level of the country

rises considerably, the hills reaching heights of 800 to 1000 feet above the river.

It is almost exclusively wooded with black spruce of eight to ten inches, which would be well suited for pulp-wood. On both sides of the river, for a distance of eight miles from Gaspé Basin, there are large areas of good land suited for farming, but in the upper parts the soil is not of good quality and moreover the level is high, so that early frosts would very probably endanger the crops.

DEVONIAN

From previous geological examinations of the region, the rocks which are referred to this system are mainly met with in the interior of the Gaspé peninsula, where they occupy a basin of great area.

Dr. R. W. Ells, of the Geological Survey, indicated these rocks as being continuous from Matapédia river to Gaspé Basin, in a band which measures 25 miles in width at its western extremity. This width decreases to ten or twelve miles in the vicinity of the head-waters of the Ste-Anne river, whereas to the east it reaches forty miles.

The rocks of this formation are sandstones and shales, red and grey in colour, sometimes hard and gritty, and in the lower strata they are associated with thick beds of limestone. The indurated and gritty beds of these rocks have offered more resistance to weathering and form long ridges or chains of hills which reach great heights.

Owing to the character of the bush and underbrush, and also on account of the thick layer of moss which covers practically the whole of the surface, our examination of the rocks had to be limited to the shore of the streams, except in a few cases when we were able to travel on the summit of some bare hills.

Nevertheless we have observed the presence of these rocks in so many places that their boundaries along the York River can be established with a fair degree of accuracy. The shores of the lake at the head of York river are partly made up of Silurian rocks and partly of Devonian, and the contact between the two formations is plainly seen half way up the lake.

Coming down the river, Devonian beds are met with as far as the forks. Below this point, wide strips of Devonian rocks alternate with strata of Silurian rocks. These bands seem to be five to six miles in width. As the stream flows at first towards the south east and afterwards swerves to the north, to finally resume a southern direction, the general strike of the rocks is therefore east and west.

From the Narrows to Gaspé Basin only Devonian rocks are met with.

SILURIAN

The rocks which constitute this geological system are mainly grey limestones cut by calcite veins; altered calcareous shales, quartzites; conglomerates of which the pebbles are limestone in a silicious and calcarous matrix. These are interstratified with beds of indurated sandstone, impure dolomite, and they contain Silurian corals, which however are so badly preserved and so metamorphosed that it is very difficult to identify them.

Silurian rocks are widely met with in the upper part of the river; they were observed near the head of the river on the lakes of the headwaters and they probably extend to the Madeleine river. Coming down the river the Silurian was observed in several places, cutting off the Devonian, but the contact between the two systems is not well defined. Near the mouth of the river, it does not show at all below Keg Creek.

Sainte-Anne River

We left Gaspé Basin on August 14th and reached Ste-Anne des Monts on the 17th after short stops at Grande Vallée, Rivière Madeleine and Mont Louis.

Two days were spent in getting ready. After having engaged eight guides and four canoes, we left Ste-Anne des Monts on the 19th. We reached the forks of the river, thirty-five miles from the coast three days later.

Leaving the forks on the 23rd of August we ascended the South arm of the Ste-Anne River, which is the more important one, and we reached Ste-Anne Lake in the evening of the 25th. It took three days to cover this distance of

ten miles, including a portage of one mile above the forks, to pass a fall of 60 feet. The river has here cut its channel on the east side of Albert Mountain, and below the fall it flows in a deep canyon, the walls of which are practically vertical and about 200 feet high. In places the river is only six feet wide but it is very deep, and above the falls it is so swift that it can only be ascended when the water is very high and even then with great difficulty.

Seven miles above the forks, in a distance of half a mile, there are five little falls, from three ta seven feet, caused by granite dykes which go across the river. We had to make five portages to go around them.

From this point to Lake Ste-Anne, about three miles distant, the river flows through a level stretch and has only a very slight fall, but it is obstructed by numerous fallen trees. The total distance from the forks to the lake is about ten miles and the general direction of the river is S. 15° E.

The forks of the river are 709 feet above sea level, and Lake Ste-Anne 1313 feet; the difference of level is therefore 604 feet which gives an average fall of 60 feet per mile between the two points.

For the first four miles from the coast, the river flows in a deep valley formed by the Notre-Dame or Shickshock mountains which rise from the banks of the river on both sides to heights varying between 1200 and 1500 feet. Beyond the range the ground is comparatively level, with low hills bordering the stream. These do not exceed 200 or 300 feet, as a rule, but a few necks of granite reach 1600 feet.

The region is the extension of the Devonian plateau which, extending from the vicinity of Matapedia Lake, along the south flank of the Notre-Dame mountain, continues on, by Ste-Anne Lake, to Madeleine and York Rivers, and underlies an almost level country.

Owing to its high elevation this plateau does not offer any interest from the farming standpoint, on account of the prevalence of early frosts. The trees are small and stunted and mainly consist in white and black spruce, balsam fir and birch. No cedar was observed above the forks of the Sainte Anne River.

Sainte-Anne Lake is four miles long and seldom more than half a mile in width. Its general bearing is south-east and it is divided into two parts by shallow narrows about three hundred feet wide.

On both the east and the west shores, granite peaks rise to heights of 1200 to 1500 feet above the lake, whereas to the north-east and south-west the ranges of hills are low, seldom exceeding five hundred feet. These hills are constituted by Devonian sandstone, this rock also flanking the base of the granite peaks. The granite is intruded through the sandstone and is part of the batholyth which forms Table Mountain to the north.

After having surveyed the lake and examined the heights which border it, we returned to the forks on August 28th. On the following day we camped in Devil's Brook coulée, within a few yards of the lake of the same name. We spent three days exploring the summit of Albert Mountain and the valleys of the various creeks which head in this mountain.

The summit of Albert Mountain is almost flat and on the east flank, it is gashed by a deep gorge, which, near its head, branches into several small radiating ravines. The sides of these coulées are quite bare of all vegetation and the serpentine rocks have weathered to a light buff colour. On the summit of the mountain are scattered large blocks of serpentine, partly covered with moss.

In the sheltered spots stunted black spruce grows to a height which seldom reaches ten feet. Near the ground the branches intertwine and form an impassable thicket. The summit or ridge of the mountain has a slight inclination from the south-west and the north-east towards the centre.

SILURIAN

This geological system is represented by a series of limestone beds many of which are fossil bearing.

This limestone formation rests, in places, on a pink or grey sandstone wihch is not very thick and which outcrops on Ste-Anne river.

The northern limit of the Silurian rocks on Ste-Anne river crosses the southern arm four miles above the forks;

from this place they occupy the bed of the river as far as a point which juts out two miles below Ste-Anne Lake, or a total distance of nearly three miles.

The soil which covers these rocks seem to be rich in lime and this portion of the region is thickly wooded; the trees however do not reach large sizes and seldom exceed twelve inches. Black spruce predominates. The region is not suited for settlement owing to frequent frosts and the shortness of the summer season.

CAMBRIAN

The Cambrian rocks along the Ste-Anne river and on the western flanks of Table mountain consist of clay shales, grey and black, limestones and conglomerates of the Levis formation.

In the vicinity of the Ste-Anne River, the Cambrian rocks extend southward as far as the base of the Notre-Dame Mountain range, where they seem to disappear under the slates and cristalline schists of the mountain, as Murray describes it in his report of 1846.

This also accounts for the apparent interstratification of conglomerate bands with the beds of chloritic schists, grey and green, in the contact zone of the two systems, wherever it is met with on the Sainte-Anne River, and more particularly at a point ten miles below the forks, as well as on a creek which flows from the north, about four miles below the forks.

PRE-CAMBRIAN

The Pre-Cambrian rocks of this region consist of the shales and altered slates which constitute Notre-Dame Mountains. They were observed along Ste-Anne River. They extend from the east shore of Matapédia Lake to the head waters of the Ste-Anne river, where they are cut off by the extensive granitic intrusion which forms Table Mountain. The width of these rocks in the region of the Ste-Anne River is about two miles. They are the oldest of the Gaspé Peninsula and on them were deposited the Silurian and Devonian rocks which show to the south.

Pre-Cambrian rocks are an important feature in the physiography of the Gaspé peninsula, for they contitute the Notre-Dame or Shick-shock mountains. This chain of mountains rises considerably above the general level of the country and their altitude increases towards the east, so that in the vicinity of Ste-Anne river, many of the peaks reach a height of 3500 feet above sea-level. Along the south branch of the Ste-Anne river, on the south side of the important mass of serpentine and peridotite which runs across the river, there outcrop hornblende schists, dark in colour, and green chloritic schists which correspond to the similar rocks on the north side, and are probably indentical, which shows that the intrusion of serpentine rocks which constitutes Albert Mountain penetrated and raised the rocks of the Pre-Cambrian.

SERPENTINE AND OLIVINE ROCKS

These rocks are well developped at the eastern end of Notre-Dame Mountains and constitute the main summit of Albert Mountain. They extend towards the South-West from Table Mountain across the South Arm of the Sainte-Anne River, up to Albert Mountain, which is very nearly the center of the intrusive mass ; thence to the head-waters of the east forks of the Petite Cascapédia River or a total distance of twelve miles. The rocks are mainly a peridotite, more or less altered to a dark green serpentine, mottled in places by reddish brown stains.

The green serpentine sometimes possesses a rough fibrous structure (picrolite) but it is present only in small quantities and moreover the quality is not sufficiently good to give it any value as asbestos.

All the outcrops of rocks seen on Albert mountain were of serpentine; but on the east slope, along the Ste-Anne River, the peridotite is only slightly altered, more especially on weathered surfaces.

The presence of chromite was observed, associated with the green serpentine, but this mineral appears to be limited to certain zones of the rock, for it is found scattered in blocks, some of which reach ten inches in diameter.

This mineral was noticed in place on the north-east slope of the mountain in banded zones of serpentine, as well as along a layer of the same rock, a couple of miles to the south of the first mentioned place. It occurs in small separate masses, scattered through the serpentine but it was not observed in sufficiently large quantities to offer economic interest.

MINING ACCIDENTS

(J. H. Valiquette, B. Sc.)

During the year 1910, 4,423 men were employed for a variable length of time in the metallic mines and the asbestos and mica mines; and in the same period, 3,500 men worked on the exploitation of quarries and in the industry of clay products. This last figure cannot be considered as giving the total number of men employed in these industries, as often the reports that we receive from the operators are incomplete and a number of small manufacturers of lime and brick or private workers of quarries do not make any reports. However the above figures show the importance of these industries and can be used for the purpose of taking proportions or establishing the percentage of persons killed or injured in these different works.

A great number of all kinds of accidents both in the mines and in the quarries have been reported to the Bureau of Mines. Fourteen of these accidents have resulted fatally, this being the number of persons killed during the past year. In considering the fact that, in all, 7,923 men were employed, this gives a ratio of 1.76 per thousand workmen. Of these fatalities, ten have taken place in the metallic mines and four in the working of stone and clay quarries: the accident death ratio for the former would then to be 2.26 and 1.14 for the latter.

It must be conceded that these results are very satisfactory notwithstanding our desire of seeing all such accidents eliminated from the mines.

The following table gives the compiled details of all the accidents that were reported to the Bureau of Mines.

Date 1910	Name of the Mine.	Name of Injured	Nature of Injury	Cause of Accident.
	Buckingham Graphite Co.	J. Burke	Broken ankle and bruise	
	Bell Asbestos Mines	Auguste Gardner	Killed	
	Black Lake Cons. Co. Ltd.	Joseph Lacroix	Killed	Rock from dump rolling over him.
12th December	" " "	Joseph Murray	Killed	Fell on track in front of moving gravel car and was crushed
	Johnson's Co.	Louis Croteau	Killed	Jammed between descending boxes
	"	Nazaire Breton	Killed	Crushed by moving locomotive
	"	T Charest	Finger crushed	Jammed between cars
	"	M Laycock	Leg bruised	Struck on leg by stones from side of pit.
	Graphite Limited	Z Lavoie	Foot cut	Cut with axe.
	" "	W. Labelle	Scalp wound	Struck on head with iron bar.
	Ascot Mine.	James Sheridan	Killed	Fall of timber and rock from side of shaft.
	Eustis Mining Co.	Wm Agon	Killed	Thrown by belt while trying to put it on a pulley.
	"	Joseph Levesque	Sprained shoulder	Tripped on rail.
	"	John Stevens	Broken ribs	Squeezed between car and chute
	"	J H Griffith	Back bruised	Struck by stone which rolled down a pile.
	"	Louis Poupore	Muscular bruises on right leg	Struck by loose rock falling.
	"	P Robitaille	" "	" "
	"	Dan. Quinnell	Finger crushed	Crushed between air-drill & rail.
	"	Alfred Shorer	Finger bruised	Jammed between boulder & car.
	"	Joseph Humphrey	Left side of lip cut	Picked into dynamite in muck.
	"	John Pierce	Injury to eye	Hit with a bar.

25th January.	Amalgamated Asbestos (King Mine)	Jos. McCutcheon	Thumb injured	Struck by stone.
4th February	" " "	Nap. Légaré	Knee injured	Squeezed between two ties.
21st January	" " "	G. Samson	Toe injured	Struck by stone.
9th February	" " "	M. Mertel	"	" "
18th February	" " "	H. Girard	Thumb injured	Struck by piece of iron.
9th March	" " "	F. St-Laurent	Finger injured	Squeezed between two stones.
17th March	" " "	Jos. Paquet	Left shoulder injured	Struck by piece of wood.
28th January	" " "	Geo. Fortier	Right side injured	In lifting piece of iron.
21st March	" " "	Jos. Gagné	Left hand injured	Struck with piece of iron
24th January	" " "	Jos. Grondin	Left leg injured	Struck by a stone.
11th April	" " "	Jos. Emond	Right hand injured	Squeezed between two pieces of wood.
16th April	" " "	Xavier Aubin	Left thumb injured	Squeezed between two boxes.
19th April	" " "	Nap. Laroche	Finger injured	Struck by a hammer.
25th April	" " "	Louis Grégoire	"	Squeezed between two pieces of iron.
26th April	" " "	P. St-Laurent	"	Struck by a hammer.
7th May	" " "	Chas Coté	Left foot injured	Squeezed between two stones.
9th May	" " "	Emile Perron	Left hand injured	Struck by stone.
7th May	" " "	A. Légault	Left knee injured	Struck by a piece of wood.
11th May	" " "	A. Paré	Left foot injured	Squeezed between two pieces of stone.
12th "	" " "	Jos. Lemay	2 fingers injured	Struck by a stone.
30th April	" " "	Nap. Bédard	Finger injured	By splinter of crude asbestos.
7th May	" " "	J. B. Voyer	" "	Struck by a stone.
13th May	" " "	Nap. Marcoux	" "	Struck by a hammer.
18 " "	" " "	Fr. Rodrique	Left hip injured	Fell on piece of wood.
18 " "	" " "	Théo. Lemieux	Finger injured	Struck by a hammer.
1st June	" " "	Cyril. Paré	Jaw injured	Struck by a piece of iron.
2nd "	" " "	Jos. Crepault	Finger injured	Struck by a stone.
3rd "	" " "	A. Mercier	Thumb injured	" "
20th "	" " "	J. Durocher	Finger broken	Squeezed in electric motor.
7th "	" " "	A. Boucher	Right arm injured	Struck by drill.

ACCIDENTS IN MINES IN THE PROVINCE OF QUEBEC IN 1910.—*Continued.*

Date 1310	Name of Mine	Name of Injury	Nature of Injury	Cause of Accidgnt.
4th July	Amalgamated Asbestos (King Mine	Adelard Roy	Left hand injured	Struck by a shovel.
7th "	" " "	O. Breton	Left thumb injured	Struck by a hammer.
11th "	" " "	Jos. Vachon	Right leg injured	Squeezed between two stones.
15th "	" " "	A. Dussault	Left leg injured	Struck by a piece of wood.
20th "	" " "	Nap. Asselin	Right side injured	Struck by a chain.
5th August	" " "	D. Berthiaume	Left knee injured	Squeezed between two stones.
10th "	" " "	Ben Simoneau	Right leg injured	Struck by a piece of wood.
30th "	" " "	Ant. Lapointe	Finger injured	Struck by a stone.
31st "	" " "	Théo. Thivierge	Rib broken	Struck by a piece of wood.
6th September	" " "	J. Payeur	Eye injured	Struck by a stone.
17th "	" " "	E. Hamelin	Leg broken (amputated)	" "
16th "	" " "	G. Leblond	Leg injured	" "
28th "	" " "	Thos. Jacob	Left hand injured	Fell on a stone,
8th October	" " "	J. A. Sullivan	Eye injured	Struck by a piece of stone.
15th "	" " "	J. Rodrique	Finger injured	Squeezed between stones.
2nd November	" " "	A. Duclos	Face injured	By falling stone.
12th "	" " "	Jos. Fortier	Left arm injured	Squeezed between two gears.
3rd December	" " "	Jos. Roy	Left heel injured	Struck by a box.
10th "	" " "	A. Paquet	Right ankle injured	By falling from a car.
12th "	" " "	T. Thivierge	Right arm broken	Struck by a piece of iron.
2nd "	" " "	Jos. Delisle	Left side injured	By falling from a platform.
25th January	Amalgamated Asbestos (Beaver Mine)	C. Cashook	Hip injured	By swinging conveyor.
25th Februray	" "	D. S. Shank	Leg injured	By fall.
6th April	" "	E. Dupont	Finger broken	By falling rock.
2nd June	" "	P. Cagnon	Arm side injuried	Fell from ladder.
14th "	" "	E. Dubois	Leg injured	By falling stone,
13th "	" "	G. Doyon	Back injured	By slipping.

15th June	Amalgamated Asbestos (Beaver Mine)	J. Covolantook	Finger injured	Struck by hammer.
30th July	" "	Alphonse Cyr.	Toes injured	By falling rock.
9th August	" "	P. Morin	Fingers injured	" "
4th "	" "	J. Stevenson	Ribs injured	Struck by car.
27th "	" "	C. Preslé	Finger injured	Jammed by stone.
17th September	" "	George Leclair	Hip injured	Falling rock.
21th "	" "	O. Pearies	Back injured	By swinging stone.
21th "	" "	E. Dubois	Hand cut	By circular saw.
24th November	" "	J. Turcotte	Ribs injured	By swinging box.
5th December	" "	N. Doyon	Back sprained	In lifting stone.
27th November	" "	J. Poolowagnick	Back injured	By swinging box.
24th June	Amalg. Asbestos (Domion Mine)	Alphonse Lord	Sprained ankle	In falling over rope.
9th February	" (Brit. Can. Mine)	M. Sprasque	Head bruised	By falling stone.
24th January	" "	F. Fomko	Nose injured	By bar.
12th February	" "	A. Douville	Leg injured.	By swinging draw-bar.
23rd "	" "	B. Marcoux	Foot injured	By rock.
1st March	" "	E. Morice	Heel injured	By falling rock.
1st February	" "	Jos. Fontaine	Two bones in foot broken	By twisting foot.
16th January	" "	P. Roulseau	Shoulder bruised	By falling stone.
28th March	" "	C. Gagnon	Body bruised	Caught between cars.
6th April	" "	J. Burette	Leg bruised	In jumping off lorry.
12th May	" "	C. Audet	Head cut	By falling.
11th June	" "	J. Duchêne	Leg injured	Caught between two cars.
9th "	" "	F. Mahervock	Thumb injured	By rock
14th "	" "	J. Carpentier	Knee injured	By swinging box.
25th "	" "	J. Coté	Ankle injured	By falling stone.
9th August	" "	J. Dubuc	" "	Crushed between rocks.
13th "	" "	J. Hamel	Lost right finger thumb	By fall.
20th "	" "	N. Pourier	Back injured	"
2nd "	" "	H. Gaulin	Ankle sprained	Fell from ladder.
31st August	" "	A. Trucoski	Finger injured	By shovel.
7th September	" "	P. Hamel	Thumb injured	By cart wheel.
10th "	" "	J. Charpentier	Ankle injured	By falling from ladder.

ACCIDENTS IN MINES IN THE PROVINCE OF QUEBEC IN 1910.—*Continued.*

Date 1910	Name of Mine.	Name of Injury	Nature of Injury.	Cause of Accident.
19th September	Amalgamated Asbestos Co. (Brit. Can. Mine)	A. Langlois	Foot bruised	By rolling rock.
28th October	" "	J. Therrien	Side injured	By fall.
21st November	" "	U. Gagnier	Ear injured	By fall of carriage.
7th June	Amalgamated Asbestos (Stan-	Jos. Boucher	Broken finger	
29th June	dard Mine			
7th July	" "	Andrew Borsbush	Finger jammed	
19th July	" "	S. Jamko	Foot injured	By falling rock.
23rd August	" "	Greg. Homanink	Bruised foot	
2nd September	" "	Arthur Auclair	Bruised body	Fell over lorry.
27th September	" "	Sanda Voicta	Finger bruised	
12th October	" "	Dymitre Brenyan	Body bruised	Struck by falling rock.
14th November	" "	Mike Ostafistuk	Finger jammed	
	" "	Jos. Lajeunesse	Kidneys injured	Struck by rock tipped over.
	Asbestos & Asbestic (Jeffrey	Antonio Godbout	Killed	By rock falling from side of pit.
	Mine)	Andrew Barnhill	Killed	By rock falling from loose pile of rocks.
	" "			
	" "	Albert Houle	Left arm amputated	Hand caught in elevator chain.
		Fred. Henri	Left eye removed	While breaking rock, piece struck him in eye.
	" "			
	" "	Noé St-Hilaire	Fractured spine	Struck by rolling rock
	The Berlin Asbestos Co.	N. Doyon	Three fingers cut off	By circular saw in machine-shop
	Robertson Asbestos Min. Co.	E. McIntosh	Leg bruised	
	" "	Jos. Landry	Three fingers cut off	
	" "	Alexo Yornenbuk	Bruised ankle	
	" "	Désiré Richard	Two fingers crushed	
	" "	Omer Lefebvre	Bruised foot	
	" "	Richard Paradis	Hand injuried	
	" "	Alfred Pomerleau	Foot cut	

"	Joseph Gagnon	Leg bruised	
"	Jim Paradis	Flesh wound on 4 fingers	
"	Jos McCortin	One bone broken above ankle	
"	Louis Pomerleau	End of finger cut off	
"	Aimé Boisvert	Foot bruised	
"	Alex. Plante	Toe injured	
"	J. Rodrigue	Wrist slighty injured	
B. & A. Asbestos Co.	J. B. Lamoureux	Killed	Derrick post fell on him
"	John Ashmore	One finger crushed	By falling stone.
"	Robert Price	Broken arm 2 ribs	By a chain whilst hoisting a big stone.
Robert Stanley	Eph. Lehoux	Back bruised	Fell out of window into empty dump-car.
Belmina Cons. Asb. Co.	Pierre Talbot	2 fingers amputated	Canght between rope and drum
"	David Carrier	Bhdy injuries	Slightly crushed between box & car.

NOTE.—In the Asbestos and Asbestic Co's mines, there have been 31 other less important accidents, evolving little or no loss of time to the injured person.

ACCIDENTS WHICH OCCURRED IN THE STONE AND CLAY QUARRIES

At the Joliette Limestone Quarry Co. Ltd., a man had an eye injured by an explosion while attempting to extract a charge from a misfire.

At the Dominion Quarry Co. Ltd., one accident occurred, resulting fatally, caused by a box of stone falling on a man named Gosselin.

On the 19th of May, a man named E. Lavoie was hurt by a blast at a quarry operated by the City of Montreal, he died on the 22nd of the same month.

At the quarry of Georges P. Desroches, a man named Israel Bernard had a hand shot off, while attempting to extract charge from a hole.

On January 13th, 1910, a man employed in the cutting shed of the Laurentian Granite Co., while grinding tools, his glove got frozen to the handle of the grind-stone, and he had part of his thumb pulled off; he was about two months idle.

At the quarry of O. Martineau & Fils, a Mr Allaire was struck by a stone causing injuries from which he died at the hospital.

At the Lapraiqie Brick Co, one man was killed and another injured.

At the Brick-Yard of C. Bourdon, a man had several bones fractured in his foot by a landslide.

We beg to call the attention of all workers of mines or quarries and of all manufacturers of lime or brick to the article 2213*a* of the Quebec Mining Law adopted by the Legislative Assembly of 1911. This article reads as follows :—

"If while a mine or quarry is being worked,an accident takes place resulting in loss of life or serious injury, the person working the same or his representative at such mine or quarry, shall forthwith send a written notice to the Minister, specifying the nature of the accident, the number of persons killed or injured and their names if they are known.

Every person not complying with the requirements of

this article, shall be liable to the penalties provided in article 2207."

As this article is self-explanatory, it is not necessary to go into any details regarding same. However, we take the opportunity of strongly urging all those whom it concerns to discharge this duty conscientiously and thereby help to the better knowledge of the precautions to be taken in the working of mines, so as to reduce to a minimum the possibility of accidents.

Moreover, it is by consulting these statistics that an idea can be had of certain weak points in our methods, and to remedy them.

Handling of Explosives

Although the number of accidents in the Province of Quebec, resulting from the handling and the use of explosive substances in the mines is remarkably small, it is a regrettable fact that a great deal of carelessness exists in many mines respecting the storage and handling of explosives. The low ratio of accidents is to be ascribed to luck rather than to good management.

There cannot be too many precautions taken in connection with the storage and the handling of explosives, and in this respect as an ounce of prevention is worth a pound of cure the advice prepared by the United States Bureau of Mines for the guidance of miners and other users of explosives, is abstracted in the following paragraphs.

Precautions to be taken in the storage and handling of explosives

Don't store detonators with explosives.

Don't open packages of explosives in a magazine.

Don't open packages of explosives with a nail puller, pick or chisel. Use a hard-wood wedge and mallet.

Don't store explosives in a hot or damp place.

Dont' store explosives containing nitro-glycerine so that the cartridges stand on end.

Don't repair a magazine until all explosives are removed from it.

Don't use explosives which are frozen or partly frozen.

Don't thaw explosives before an open fire, nor in a stove, nor over a lamp, nor near a boiler, nor near steam pipes, nor by placing cartridges in hot water.

Don't put hot water or steam pipes in a magazine for thawing purposes.

Don't carry detonators and explosives in the same package.

Don't handle explosives or detonators near an open flame.

Don't expose explosives or detonators to direct sunlight for any length of time.

Don't open a package of explosives until ready to use the explosive, then use it quickly.

Don't handle explosives carelessly.

Don't crimp a detonator (blasting cap) around a fuse with the teeth. Use a cap crimper.

Don't economize by using a short length of fuse.

Don't tamp the explosive with coal cuttings or any inflammable material.

Don't use a metal tamping rod.

Don't use two kinds of explosives in the same hole.

Don't return to the face for at least one half hour after a misfire.

Don't leave any detonators or explosives in a mine over night. The mine air contains moisture and is bad for explosives.

I have the honour to be,

Your obedient servant.

THEO. C. DENIS,

Quebec, May, 1911. *Superintendent of Mines.*