CIHM
Microfiche
Series
(Monographs)

ICMH
Collection de
microfiches
(monographies)

Canadian Institute for Historical Microreproductions / Institut canadien de microreproductions historiques

Technical and Bibliographic Notes / Notes techniques et bibliographiques

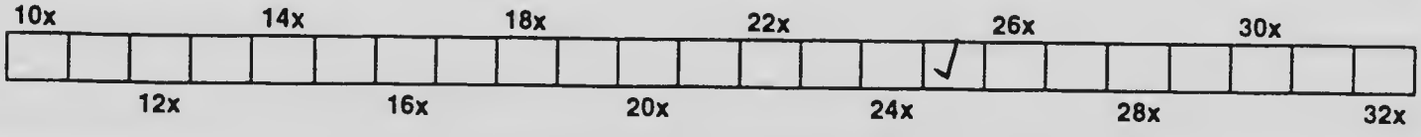
The Institute has attempted to obtain the best original copy available for filming. Features of this copy which may be bibliographically unique, which may alter any of the images in the reproduction, or which may significantly change the usual method of filming are checked below.

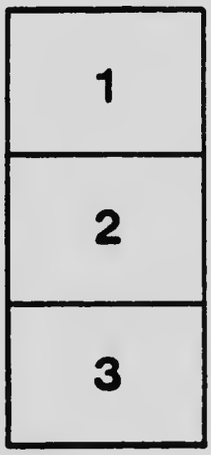
- ☐ Coloured covers / Couverture de couleur
- ☐ Covers damaged / Couverture endommagée
- ☐ Covers restored and/or laminated / Couverture restaurée et/ou pelliculée
- ☐ Cover title missing / Le titre de couverture manque
- ☐ Coloured maps / Cartes géographiques en couleur
- ☐ Coloured ink (i.e. other than blue or black) / Encre de couleur (i.e. autre que bleue ou noire)
- ☐ Coloured plates and/or illustrations / Planches et/ou illustrations en couleur
- ☐ Bound with other material / Relié avec d'autres documents
- ☐ Only edition available / Seule édition disponible
- ☐ Tight binding may cause shadows or distortion along interior margin / La reliure serrée peut causer de l'ombre ou de la distorsion le long de la marge intérieure.
- ☐ Blank leaves added during restorations may appear within the text. Whenever possible, these have been omitted from filming / Il se peut que certaines pages blanches ajoutées lors d'une restauration apparaissent dans le texte, mais, lorsque cela était possible, ces pages n'ont pas été filmées.
- ☐ Additional comments / Commentaires supplémentaires:

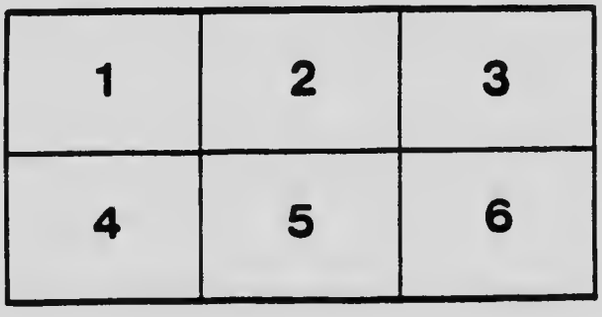
L'Institut a microfilmé le meilleur exemplaire qu'il lui a été possible de se procurer. Les détails de cet exemplaire qui sont peut-être uniques du point de vue bibliographique, qui peuvent modifier une image reproduite, ou qui peuvent exiger une modification dans la méthode normale de filmage sont indiqués ci-dessous.

- ☐ Coloured pages / Pages de couleur
- ☐ Pages damaged / Pages endommagées
- ☐ Pages restored and/or laminated / Pages restaurées et/ou pelliculées
- ☑ Pages discoloured, stained or foxed / Pages décolorées, tachetées ou piquées
- ☐ Pages detached / Pages détachées
- ☑ Showthrough / Transparence
- ☐ Quality of print varies / Qualité inégale de l'impression
- ☐ Includes supplementary material / Comprend du matériel supplémentaire
- ☐ Pages wholly or partially obscured by errata slips, tissues, etc., have been refilmed to ensure the best possible image / Les pages totalement ou partiellement obscurcies par un feuillet d'errata, une pelure, etc., ont été filmées à nouveau de façon à obtenir la meilleure image possible.
- ☐ Opposing pages with varying colouration or discolourations are filmed twice to ensure the best possible image / Les pages s'opposant ayant des colorations variables ou des décolorations sont filmées deux fois afin d'obtenir la meilleure image possible.

This item is filmed at the reduction ratio checked below /
Ce document est filmé au taux de réduction indiqué ci-dessous.







DEPARTMENT

OF

LANDS, MINES AND FISHERIES

MINING OPERATIONS

IN THE

PROVINCE OF QUEBEC

FOR THE YEAR

1903

In connection with the annual report of the Department for the fiscal year 1902-1903

BY

J. OBALSKI,

MINING ENGINEER AND INSPECTOR OF MINES.

DEPARTMENT

OF

LANDS, MINES AND FISHERIES

MINING OPERATIONS

IN THE

PROVINCE OF QUEBEC

FOR THE YEAR

1903

In connection with the annual report of the Department for the fiscal year 1902-1903

BY

J. OBALSKI,

MINING ENGINEER AND INSPECTOR OF MINES.

Hon. S. N. Parent,

Minister of Lands, Mines and Fisheries,
Quebec.

Sir,

I have the honor to submit the detailed report on Mines, in the Province of Quebec, for the year 1903.

The progress pointed out in previous reports continues to make itself felt regularly especially as regards asbestos, copper, mica and chrome which have become permanent industries.

The manufacture of cement is in the way of acquiring great development in consequence of the establishment of new factories.

We shall probably see this year the formation of *bona fide* companies with proper plant for the preparation of graphite and pressed peat.

Progress has likewise been made in the treatment of magnetic sands and there is reason to hope that within a few years the province will be endowed with a new industry in connection with this speciality.

The discovery of minerals containing radium is calculated to encourage the working of white mica mines in which these minerals have been found.

The Mining Law has worked satisfactorily. The Montreal Assay office has continued to do excellent work and the number of consultations, both at that office and Quebec, is increasing to a marked degree, showing the interest taken in mining industries while helping the discoveries that are being made in the new territories.

This report contains a detailed study on the chrome industry and is accompanied by a map of the township of Colraine. Articles will also be found in it on new subjects such as manganese and the minerals containing radium.

Two hotel licenses have been granted during the year under the Mining Law, a prohibition by-law having been passed in certain mining districts.

The protection of workmen, as well as of women and children, is properly safeguarded according to law. Only one man is reported to have been killed and two seriously injured in connection with mining operations. Good order is preserved in the mining district through the efforts of our police sergeant.

The total yield of mineral products shipped from the mines, this year, represents a sum of three million dollars.

I have the honor to be,

Sir,

Your obedient servant,

J. Obalski,

Mining Engineer and Inspector of Mines.

Quebec, April, 1904.

IRON

During the past year no important work was done in our mines but explorations and prospects have been continued which will, in time, allow of these mines being improved and made more valuable.

Last spring, I again visited the magnetic iron mine in Leeds and ascertained the extensive development of the veins I had pointed out in my report for 1901 and which, as I had foreseen, were nothing but outcroppings of ore which had been bared at certain points. It may therefore be concluded that this deposit is an important one. Nevertheless it is somewhat distant from fuel and from communications, but it could easily be connected with the Quebec Central or Grand Trunk or directly with the river at St Jean Deschaillons wharf about fifty miles distant. That port is connected by the Lotbiniere and Megantic R. R. with Lyster, about 20 miles from the mine.

A recent analysis of a selected specimen made by Mr. Milton L. Hersey, showed :

Metallic iron	62.52 %
Sulphur	0.166%
Phosphorus	0.164%
Titanium	0%

A deposit of magnetic iron which seems an important one was discovered on cadastral lot No. 1300 of range X of East Bolton (Brome). It was prospected in the autumn by Messrs. John McDougall and Co, of Drummondville, who got out a couple of hundred tons and propose to work it regularly and to use the ore in the Drummondville forges.

I visited the Saint Boniface iron mine, situate on lots VII, 23 and 24 of Shawinigan, which was formerly worked to supply the blast furnace erected in the vicinity. This deposit is a rather important one and can be observed over a large surface, running over a mile across other lots in a north-easterly direction. The ore contains a

quite considerable proportion of titanium and is hardly susceptible of immediate use in the present conditions of the metallurgic industry.

MAGNETIC SANDS

The practical utilization of these sands existing in such abundance on the North Shore, continues to attract attention and experiments are still being made in connection with them.

A new process of forming briquettes of the ore, patented in England, under the name of " The Rouse process " is spoken of but we have not yet received any information on the subject. Several other attempts at agglomerating and smelting these sands are also mentioned but it is not to our knowledge that any of them has had a practical result. The question of concentrating the crude sand continues to be studied and, last summer, experiments were made with the Carter's auto-magnetic separator which seems to have given very good results if one may judge by the examination I made of the concentrate obtained which was sent me and which contained only 0.65% of titanic acid. The chief feature of this concentrator is that it requires no power to work it, consisting as it does of inclined planes provided with magnets and whence the magnetized part falls by its own weight when the magnets are over-loaded. It would therefore suffice to feed this apparatus in some way and to remove the finished products at the base by means of a similar process. The Carter separator treats the dry sand but I have already suggested that hydraulic concentration be first effected which would leave only the metallic part consisting of magnetic oxyde and titanic iron. This dried part would then be treated with the separator. I consider, however, that it would be preferable to employ a combined hydraulic and magnetic separator which would treat the natural sand without drying and all the efforts of inventors should tend in that direction. I also consider that one should confine oneself to the action of the magnets without having recourse to the use o electric power which is more difficult to regulate, for one must not lose sight of the fact that the titanic ores are also slightly magnetic and that the object in view is to eliminate the titanium as completely as possible.

I had occasion to visit the experimental plant set up at Lockport N. Y., by Mr. Ruthenburg to demonstrate his plan of agglomerating magnetic sand by electricity. As I have already stated in my report for last year, the principle lies in the fusion or at least in the

softening of the magnetic oxyde by the temperature of the electric arc, the ore being arrested between the two poles of a magnet also comprising the zone of fusion. At such a high temperature the ore ceases to be magnetic and falls naturally, the grains of sand so softened uniting together. Mr. Ruthenburg calls this operation "*fritting*" and he had intended to mix charcoal or crushed coke with the sand to produce a partial reduction. The improvements in the process, as mentioned last year, are the following :

1. 250 kilowat hours are sufficient to fritt or agglomerate a ton of ore ;

2. It is no longer necessary to cool the carbons, serving as electrodes, with a water-jacket and the apparatus consists merely of an electro-magnet provided with two fixed carbons which, in the experimental apparatus, are about ten inches long and are separated by a space of one inch ; the capacity of this experimental apparatus was found to be four tons per 24 hours.

The operation might stop there and the product obtained could be used in the blast furnaces but the heat retained by the ore so agglomerated would be lost. To utilize it, Mr. Ruthenburg gave up the idea of mixing the sand with powdered charcoal and makes it fall into a tower of refractary brick through which he causes a current of reducing gas produced by a special generator to pass. This gas, consisting especially of oxyde of carbon, effects at least a partial reduction of the oxyde of iron at the high temperature retained on issuing from the electric furnace above described, and the mixture formed of carburetted iron, after remaining 24 hours in the tower, is collected at the base and, conveyed directly to the cupola or reverbatory furnace and can thus be treated for pig iron or steel.

Mr. Ruthenburg claims that it takes 250 kilowat hours for the operation of fritting, and if the power can be obtained at a very low price, the operation would certainly enable the ore to be utilized. He states, theoretically, that if, by means of water-power, ten dollars per horse-power were paid throughout the year the cost of the fritting could be reduced to 37 cents per ton of 2000 lbs. This price is certainly fictitious for the conditious of permanent work could hardly be obtained ; neverthless even an amount of one dollar could be applied advantageously to our sands.

The complete process down to the steel could hardly be followed on the spot where the sand is found on the North Shore, but I am assured that, by using canal boats, a rate of freight could be obtained not exceeding $1.50 from the North Shore to Buffalo, to which price should be added the duty of 40 cents on entering the United States, leaving a sufficient margin for pure ore with a proportion of 70% of iron and worth about $5.00.

This margin, if applied to the extraction, concentration and conveyance to the shipping point, would be sufficiently remunerative in the case of contracts for large quantities, not less than one hundred thousand tons per annum, and I understand that a metallurgical company, working with the aid of the power obtained from the Niagara Falls and following the full Ruthenburg process, would be disposed to consider such a proposition.

I would recall the fact that our concentrated magnetic sand contains 70 % of metallic iron, but little or no sulphur or phosphorus and less than one per cent of titanium, and thus constitutes a first class iron ore when suitable conditions for agglomeration can be secured.

I refer, for details, to the paper read by Mr. Ruthenburg at the meeting of the Electro Chemical Society, at Niagara Falls, on the 17th September, 1903.

I consider that it will be interesting to summarily discuss the position that would be most advantageous for our province in connection with the working of our iron ores.

According to the statistics of the Geological Survey, there were produced in 1902 in all Canada :

71,664 tons of pig iron obtained from Canadian ore.
281,238 " " " foreign "

Total... 352,902 tons, 18,865 being charcoal pig iron.

This total was obtained by 6 companies having 9 blast furnaces in operation in Nova Scotia, Quebec and Ontario.

75,195 tons were exported and 40,016 tons imported.

Thus, in 1902, the consumption in Canada was 352,902 tons plus 40,016 less 75,195, say 317,723 tons that is only 35,179 tons less than we produced.

If we now consider the production of the ore used, we find that, for the same period, it was 404,003 tons in 1902, mostly from Ontario, of which 278,339 tons were exported to the United States. Thus in Canada 125,664 tons of Canadian ore were used to which must be added 559,381 tons of foreign ore imported, a considerable proportion coming from Newfoundland, making a total of 685,045 tons of ore used during the year to produce the 352,902 tons of pig iron above mentioned.

On looking into these figures, we find that we have produced a quantity of pig iron slightly in excess of what we needed for home consumption but that, probably on account of the geographical situation of the blast furnaces and of the mines, we have imported 559,381 tons of ore and have exported 278,339 tons, chiefly to the United States in spite of a duty of 40 cents per ton.

The conclusion that can be reasonably drawn from these figures is that it is not necessary for the moment to develop our metallurgical industry, but rather to encourage our iron mines with the view of making up the margin of 559,381 tons of ore, representing the excess of the total consumption over the proportion of Canadian ores used by our blast furnaces.

It is true, as I stated above, that the geographical conditions, as well as the quality of the ore, play a prominent part in the matter but we should lay down the principle that we have no outside market of any importance for our pig-iron while we have a great market for our ores, especially when they are of the best quality, such, for instance, as our magnetic sands of the North Shore.

I would add that the iron industry in Canada has grown in consequence of the protection given it as follows :

1. A customs duty of $2.50 per ton of 2000 lbs of pig-iron imported;

2. A bonus of $3.00 per ton of pig-iron produced in Canada from Canadian ore and of $2.00 when produced from foreign ore ; the bonus varies between these two figures according to the proportion of foreign ore;

3. In the Province of Ontario, a bonus of $1.00 per ton of pig-iro produced from ore of the province;

4. A customs duty of $7 per ton of iron or steel for rails or of rails

5. A bonus of $3 per ton of bar iron and steel manufactured ir Canada from Canadian pig iron ; a limit of 50 % of foreign products is nevertheless allowed in the production of steel.

These federal and local bonuses decrease from 1904 to 1907 when they cease, unless the governments see fit to renew them.

MANUFACTURE OF PIG-IRON

The charcoal blast furnaces at Radnor and Drummondville worked regularly for a part of the year and the following figures show the operation and production of these furnaces:

Pig iron produced....	9,635 $\frac{1436}{2000}$ tons	worth $	230,639 46

The charges were as follows:

Ore charged.....	20,746 $\frac{640}{2000}$ tons	worth $	70,715 00
Lime stone charged.	2,377 $\frac{1535}{2000}$ tons	do	1,406 00
Charcoal charged....	1,203,412 bushels	do	96,759 00

The number of workmen was about one hundred without counting those employed in cutting wood, extracting ore, making charcoal and in transporting, numbering in all about 800 and the blast furnaces were in operation for twelve and six months respectively. The ore used was partly bog ore from the neighborhood of Drummondville, Lac à la Tortue and from the counties of Champlain, St-Maurice, Joliette, Nicolet and Vaudreuil. Neverthless, in the ore charged, as stated above, are included ten thousand tons of various ores obtained elsewhere, especially from the Province of Ontario.

The quantity of bog ore from this province that was used represents therefore only 10,746 tons, worth $34,985.00.

TITANIC IRON

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 not be possible to enrich them and whether the titanium could not be got rid of by means of magnetic concentrators. Some results, although still insufficient, were obtained and this year, thanks to the kindness of Dr. W. L. Goodwin, Director of the Kingston School of Mines, a fresh experiment was made on two tons of ore from Seven Islands on the North Shore with the following results :

Analysis of crude ore :

Peroxyde of iron	22.02
Protoxyde of iron	33.60
Bisulfide of iron	0.90
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 the Watherill electro-magnetic separator.

17 lbs crushed at 30 meshes (0.05 inch) yielded 9½ lbs of concentrate containing :

Iron	53.36
Titanic acid	19.19

and 7½ lbs of tailings, containing :

Iron	27.60
Titanic acid	35.59

40 lbs crushed at 100 meshes yielded 26½ lbs of concentrate, containing :

Iron	49.9
Titanic acid	20.6

and 14½ lbs of tailings, containing :

Iron	28.72
Titanic acid	34.77

The remainder of the two tons of ore, representing 3,417 lbs w
crushed at 30 meshes and yielded 2,221 lbs of concentrate, say 65
containing 18.8% of titanic acid.

These experiments were made by the Professor of Metallurgy, M
S. F. Kirkpatrick, who concluded that, notwithstanding the partiall
satisfactory result obtained, the concentrates contain far too great
proportion of titanium to allow of their being utilized as iron ore

From Kenogami (Lake St. John) 100 tons were shipped for exper
imental purposes.

The question of the utilization of titanic iron is still being studied
but so far no definite results seem to have been obtained.

OCHRE

Ochre was extracted and calcined at Saint Malo near Three
Rivers by two companies : The Canada Paint Company, and the
Champlain Oxyde Company, employing some fifty workmen and
working for 6 and 7 months, the quantity produced and shipped being
1746 tons, worth $20,440.00.

CHROMIC IRON

In 1898, some years after the discovery of chromic iron in Colraine, I published a special report on this new industry with a map. The edition of that pamphlet has long been exhausted and, in view of the many requests for information and the development in the concentration of those ores, it has been deemed necessary to publish a new edition which will reprodnce a portion of the former one with fresh facts that have occnrred since that time.

According to the report of the Geological Survey of Canada, for 1863. the first attempt to mine chromic iron was made in the vicinity of lake Nicolet, whence a dozen tons were shipped in 1861 from lot 11.4 of South Ham, then owned by Mr W. Russell. Abont 1886 some tons were also got out of lot 111.24 of Wolfestown (Wolfe Co.). In 1887, Dr James Reed sent a shipment to Philadelphia of 54 tons obtained from lot X.1 . Leeds (Megantic Co.) and took out from 4 to 5 tons of low grade from IV.16 of Thetford (Megantic Co.) Abont the same time he also sent specimens to the Antwerp exhibition in Belgium. These specimens seem to have attracted attention in Enrope and I remember that I was applied to for the pnrchase of 2000 tons which was to serve as a basis for snbseqnent contracts at very remnnerative prices. The indications found did not seem to jnstify the hope that large deposits would be found and work was discontinned.

In April, 1894, Mr. Provençal, of Black Lake, accidentally discovered an unknown mineral in the neighborhood of that village in Colraine and formed a partnership with Mr. Jos. Nadeau. The mineral found was submitted to me ; I identified it as high grade chromic iron and recommended the developing of this prospect. This was the first work done in connection with chromic iron in block A, of Colraine, under the name of the Nadeau and Provençal Mine. The prospectors then set ont and other deposits were fonnd at several points in the township of Colraine as well as in Garthby and other townships but, so far, with the exception of two points in Garthby and one in Bolton, all the ore sh:pped from Canada comes from the township of Colraine. This township, which also contains the important asbestos mines of Black Lake, is quite unfit for cultivation, consisting as it does of serpentine rocks, denuded by fire with the exception of a few lots

from which the good timber has been removed. The Governm
therefore considered that this territory could be of use solely for
mining industry and decided that the lots in this township could
sold only for mining purposes. A glance at the annexed map w
show that the Crown still owns the greater portion of them.

Chromite or chromic iron is not found in the form of crystals b
only in compact masses of a metallic, black color with a streak ar
brown dust which is very characteristic ; its hardness is 5 and 6.
breaks easily under the hammer, at least in the case of pure specimens
while the more ferruginous ones are more resisting. Its density is
to 5, say about 7 cubic feet to the ton. It is not magnetic ; some o
it is found, however, at times possessing that property, but this is due
to its being mixed with magnetic iron while the deposits containing
this variety are generally poor and so far have not been looked upon
as workable. Theoretically chromite consists of 32 % of protoxyde
of iron and 68 % of sequioxyde of chrome, but in commercial varieties
magnesia partly replaces the protoxyde of iron, while alumina and
sesquioxyde of iron replace the sesquioxyde of chrome. A little lime
and a slight proportion of silica are also found. All these elements
are of great importance with regard to sales, for a limit in iron and in
silica is exacted by purchasers for certain purposes. Thus the pro-
portion of iron must not exceed 1 to 3 of metallic chrome or again
10 % of metallic iron in all ; over 4 % of silica is also objected to.

I give below the complete analysis of some samples most of
which were made in the provincial laboratory by Mr. Milton L. Hersey.

IRELAND III—26 (King Brothers.)

Sesquioxyde of chrome	60.21	56.14
Protoxyde of iron	14.41	14.86
Silica	0.40	2.98
Lime	1.46	0.70
Magnesia	15.50	15.69
Alumina	7.89	8.71
Moisture	0.15	0.09
	100.00	100.00

COLRAINE B. 6. (American Chrome Co.)

Sesquioxyde of chrome	47.69
Protoxyde of iron	14.33
Silica	4.70
Lime	0.50
Magnesia	14.47
Alumina	18.31
	100.00

The following analyses are those of ores sent to the Paris Exhibition of 1900 and were supplied by the Colraine Mining Company.

	Sesquioxyde of chrome.	Protoxyde of iron.	Alumina.	Magnesia.	Lime.	Silica.
No 1, crude ore	51.06	13.63	14.66	14.20	2.27	4.18
No 2, do	45.26	12.72	16.80	18.27	2.34	4.61
No 3, do	40.12	11.20	18.63	22.52	2.65	4.87
Concentrate	53.64	11.47	14.02	15 75	2.81	2.31
Tailings	2.86	traces	32.55	45.26	4.18	16.15
Slime	1.27	traces	31.33	46.16	4.24	17.03

CONCENTRATE (Black Lake Chrome & Asbestos Co.)

Sesquioxyde of Chrome	50.35
Protoxyde of iron	17.77
Silica	3.10
Lime	1.80
Magnesia	16.02
Alumina	9.90
Moisture	1.06
	100.00

The highest analyses gave 65.16 for a specimen from the Colraine Company, but many analyses gave over 60%. Moreover, in practice, such high averages are not reached and the purchasers are content with 50% ; nevertheless some shipments have frequently given more. A shipment of several cars of ore from Breeches Lake, in Garthby, is cited which gave 55%.

The Province of Quebec is the only one in Canada which pro duces chromic iron and this industry is confined to the serpentine bel running across the Eastern townships which also contains the important asbestos mines of that region as well as deposits of steatite and magnesite not yet worked.

This serpentine appears above ranges V and VI of Bolton, forms part of the Orford mountains, passes to the east of lake Brompton, then towards ranges V and VI of Melbourne, XIV and XV of Cleveland, shows up at Asbestos, in Shipton, in range XI of Tingwick, then in Ham North and Ham South towards lake Nicolet, in Garthby, on ranges I and II with another spur on range V. It then assumes a greater development in Wolfestown whose south-eastern portion it covers starting from range VIII, covers the whole south-eastern portion of Ireland and blocks A & B of Colraine where it forms the mountains west of Black Lake. This serpentine practically occupies the entire township of Colraine, forming hills 900 feet high between Black lake and Caribou lake, extending even over the western portion of Adstock where the Grand Morne mountain is partly made up of that rock. It then continues, gradually narrowing, towards Thetford and Broughton where it finally disappears.

A little serpentine is also found on the river des Plantes, in Beauce, then in range V of Cranbourne, on the river Etchemin and afterwards it does not make its appearance until Gaspesia is reached where, under a slightly different aspect, (being reddish in color) it forms the great mass of Mount Albert at the head of the river St Anne. There is also a little on the river Dartmouth near Lady's Step brook and perhaps in some other unexplored parts of Gaspesia. A similar serpentine has been found, forming large masses, on the west shore of Newfoundland, at Port au Port bay, where the characteristic minerals, asbestos and chromic iron have been worked.

The most interesting portion of this succession of deposits of serpentine is that which embraces the township of Colraine with, on one side, part of Ireland, Garthby, Wolfeston and Ham and, on the other, Thetford and Broughton. In this section are the mines of asbestos and the principal deposits of chromic iron which we will now describe.

I would recall the fact that these rocks have been classified by the Geological Survey in the Cambrian group. The serpentine there is dark green in color, presenting a reddish surface in the parts that

have been exposed to atmospheric influences and forest fires. It is generally compact in structure but at some points, on the edges of the strip, it is schistous, constituting the transition between it and the rock (generally dioritic) accompanying it. Thus in Colraine, between lake Caribou and little lake St. Francis, there is an unproductive zone consisting seemingly of diorite. The serpentine is also crossed by dykes of eruptive rock that has been called granulite and consists of quartz and feldspar in the amorphous state. The best development of this rock is to be seen on the little island in Black lake ; it afterwards appears near the line of the Quebec Central Railway to the south of Black Lake station ; it is found in the Black Lake asbestos mines, then on lots 28 of ranges B and A of Colraine and also in the Thetford mines especially on lot 28 of range VI of Thetford. It has been sought to establish a connection between the presence of these dykes and the origin of asbestos and chromic iron, but nothing definite has been established on the subject.

Chromic iron is found exclusively in serpentine and only in irregular pockets ; in some instances these pockets are more or less developed in one direction and it has been thought that a kind of vein or seam had been found but, in my opinion, this is wrong for none of the characteristic features of deposits of that kind are to be observed and moreover there are no walls.

Chromic iron seems to me, therefore, to form an integral portion of the serpentine of the Eastern Townships and becomes suitable for working when isolated in larger masses. Outwardly, chrome manifests itself by a kind of spongy crust, of ferruginous aspect, or by abundant grains in the rock. Sometimes these indications exist on the surface only ; at others they penetrate into the rock with depths of several inches or several feet. Sometimes also large masses are found on the surface ; thus the first discovery made in Block A. of Colraine showed a thickness of 16 feet which completely disappeared at a depth of 15 feet. From this pocket, 1300 tons of high grade ore were taken out while others were found in the vicinity which were also worked and partly emptied. This irregularity causes uncertainty in working which prevents putting in extensive plants. Owing to the slight depth attained, 11 feet at the most, it is impossible to say what is underneath but I am of opinion that underground deposits are quite as likely to be found as surface ones, and I may mention a shaft sunk for asbestos on lot C 32 of Colraine where, without

any surface indication, a small mass of chromic iron was found at depth of 30 feet. The idea has been suggested of boring with diamond drill to ascertain the depth at which the chromic iro may lie but, owing to uncertainty as to the points to be operated o such borings would be of advantage only in regions where surfac indications have been found. Chromic iron does not exist in the yello serpentines of the Laurentian region and, in the Eastern Township it is not found with asbestos although in the same belt of serpentine but in an almost parallel and adjacent zone, as shown on the annexe map.

I give below the places where chromic iron has been found.

COLRAINE

This township is the most important from the point of view of chromic iron and practically all the ore got out and shipped comes from there. The first discovery was made between the line of the railway and lake Caribou ; then followed others on the west side of Black lake and afterwards on various lots of that township, especially in the vicinity of Little Lake Saint Francis, as well as in ranges IV and A.

The former Colraine Mining Company (now the Black Lake Chrome and Asbestos Company)

Blocks A and B comprise about 5000 acres, and belong to this company which, in 1894 and 1895, granted the right of mining to small parties of local miners on condition of the payment of 50% of the net output and further subject to certain conditions as to working. The lots were 2 acres in width and 14 in length. Some were thus conceded on both sides of Black Lake and gave rise to mining on a small scale which yielded enough to pay the workers.

These mines were known under the following names :

To the south-east of Black Lake and of the Quebec Central R. R.

Lambly Mine. The first discovery was made on this lot. Mr. J. Nadeau who first worked it, got out 800 tons, then the company got up by Mr. Lambly and others took out 500 tons, the mass then in sight comprising a surface deposit of from 5 to 10 feet by 30 in length with

other indications followed for a distance of from 200 to 300 feet. Mining was carried on to a depth of some fifteen feet and another neighboring deposit was worked, yielding 800 tons, in addition to about a hundred tons from other small pockets. Thicknesses of nine feet of ore were found and work was carried on to a depth of 65 feet. The total quantity taken out from this lot was about 2300 tons which were shipped, the ore being first quality as a rule. Work was done by hand and with no other appliances for extracting than a horse-derrick.

Victoria Mine. This is north-east of that last mentioned. It was worked in the summer of 1895 by Mr. P. P. Hall and others and with the same appliances yielded a total of 1300 tons. All the ore was taken out of a single pocket which at times showed masses from 10 to 12 feet in width by from 7 to 8 feet in height and work was carried on to a depth of 100 feet. The ore was high grade, frequently exceeding 40%.

Frechette Mine. Situate a mile and a half to the north-east of the Lambly Mine and almost on the summit of Black Lake mountain, about 600 feet above the railway. It yielded nearly 1000 tons of very high grade ore. The workings consisted of slight superficial excavations by hand which were continued for several years. The high grade is shown by the fact that the tailings of the mine, holding 40.76 % gave concentrates holding 60.66 %.

The Lake Caribou Chrome Mining Company. Situate near lake Caribou in a schistous serpentine and worked on the side of the mountain. It produced about 800 tons of average grade ore.

Blondeau and Roberge Mine. In the same region. It yielded about 350 tons.

Dumais Mine. Also near lake Caribou in a very loose rock, presenting certain difficulties as regards working: it produced 500 tons.

The last three mines are at an altitude of from 400 to 500 feet above the railway and at a distance of about one mile from it. The ore is found in blocks of varying dimensions in a schistous serpentine which prevented deep working with the very elementary appliances used.

In addition to the foregoing mines and in the same section, oth
prospects were carried on in 1896, 1897 and 1898, with good resul
but were not followed up by mining. They reverted in succession t
the Colraine company which decided to work them itself and did no
renew the contracts.

The following mines, also on the lands of the Colraine company
are situate to the west of Black lake at altitudes of from 400 to
500 feet above that lake : they were worked to a slight extent from
1894 to 1896 and then reverted to the company. The ore was found
to be abundant and of a good grade : the little that was got out was
shipped at Chrome siding (Q. C. R.) about a mile and a half distant.

Lemieux Mine.—This mine yielded 70 tons of a good grade which
were shipped ; the ore was first found in a solid state of a thickness
of from 1 to 2 feet ; then, a short distance away, of a thickness of
from 1 to 4 feet on a length of about one hundred feet in a northerly
direction. The ore of this last deposit had but little consistency and
easily reduced itself into sand.

Nagyes Mine.—Presented a large block of ore which yielded 110
tons ; a car of hand picked ore was shipped.

Beaudoin Mine.—Showed fine indications and a small quantity of
ore was got out but not shipped.

Other prospects by Messrs. Roberge Brothers, in the neighbor-
hood of the Ireland line, also established the existence of chrome in
that region.

In 1897 the Colraine Mining Company having come into possession
of all the mines, with the exception of the Frechette, Hall and Lambly
mines, began working at the spot where shaft No. 1 is now and, in
that season, got out about 2,000 tons, 658 of which were shipped,
taken from two excavations 60 feet deep worked for six months with
some twenty men. Until the end of 1897 nearly 7,000 tons had been
extracted from the company's lands, 5,500 of which were shipped. The
last deposit worked graded about 45 % and to utilize the tailings the
company decided to put up steam machinery and concentrating
works. Trials were made with which I will deal in a special chapter.

In 1898, a concentrator was put up on the very shore of Black lake, 100 feet below the railway : the mines were fitted up with small steam-engines working the derricks, drills and the pumps for draining the works. The workings included shaft No. 1 and shaft No. 2 in the immediate vicinity of one another, No. 3 on the former Hall shaft which had then reverted to the company, No 4 the old Blondeau and Roberge shaft and No. 5 or Caribou shaft, a new one.

Work was thus continued nearly all the year round from 1899 to 1901 with a force of from 60 to 80 men : the mill was finished in 1899. In 1900, shafts 1 and 2 were combined into one and attained a depth of 105 feet ; No. 5 was down to 40 feet and the output was regular. Crude ore of good grade was shipped in two qualities : 50 % and 45 % and the concentrates from the mill, about 50 %. During this period frequent changes in the management of the mine and alterations in the concentrator which did not quite realize what was required of it, prevented this property from assuming the expected development and in 1901 work was suspended at the mine and at the mill ; the company merely shipped what remained over from the previous season. At the end of 1902 things were put in order, the shafts were emptied and a new plan was proposed for the concentrator.

At that date the properties of the Colraine Company passed under the control of the *Black Lake Chrome and Asbestos Company* of Montreal which is at present developing them in a very remarkable manner with results whereof we will proceed to give an idea.

The company worked through the year 1903 with about a hundred men. The shafts were emptied and worked regularly. They are known as shaft No. 1, former shafts 1 and 2 ; No. 2, Hall shaft ; No. 3, Blondeau and Roberge shafts ; No. 4, Caribou shaft. The most important work was done at shaft No. 1 which has now attained a depth of 120 feet. At the time of my visit in November last, a thickness of ore of some ten feet was found at the bottom which was followed by means of a large cutting and which produced 10 tons of crude ore per day besides 25 tons of tailings for concentration. From 12 to 15 men worked regularly and were assisted by a steam derrick, the same engine also driving a pump and a drill.

No. 2 was not worked but there was some question of putting i steam machinery.

No. 3 was prospected by contract but, owing to the sliding nature of the ground, the ore was followed by an open cutting ; the indications were very satisfactory.

No. 4. This work yielded considerably under the former company and, owing to the nature of the rock on the surface, it was deemed necessary to sink a timbered shaft to a depth of 60 feet, where the ore body found at the surface was struck again and at the bottom it presented a thickness of several feet, partly high grade ore. The new company has cleared the surface by removing about twelve feet of earth and will mine all the rock in which a good deal of chrome is mixed. At the same time it continues deepening the works and is putting in steam machinery. This lake Caribou district has also been considered of sufficient importance to have a special concentrator. Accordingly, a frame building 70 x 20 has been erected near No. 4 with an annex 35 x 20 for the boiler.

The concentrator comprises a Blake crusher of 20 inches placed below, 10 stamps of 1200 lbs, the screens being of the dimension of 20 meshes. The ore goes from the crusher to a hopper which feeds it automatically to the stamps whence it goes to three Wilfley concentrating tables. The various parts of the machinery are connected by elevators, etc ; the power is supplied by a 35 horse-power engine, the water being taken from lake Caribou by a small pump driven by a cable worked directly by the machinery of the mill. The works are built in a simple and effective manner ; their capacity, for 20 hours is 8 tons of concentrate supposed to be obtained from 30 to 35 tons of tailings. I understand that the company has just made arrangements with the St. Francis Water Power Company to utilize the electric power distributed by the line recently erected by that company from d'Israëli to Thetford.

At the mine itself a steam derrick has been put up which is worked by a 25 horse-power engine.

At the date of my visit in November, this mine had been worked by contract with about ten men yielding 4 tons of ore and 4 tons of

tailings per day, the proportion being 1 first class to 2 second class. The mill was put in operation last October.

The old concentrator situate near Black lake was transformed in the following manner : the ore is still crushed by means of three crushers (Blake system). The rollers have been replaced by 10 stamps to which 10 others were afterwards added : 10 Wilfley tables have been put in and the cylindrical drier removed. The works are lighted with the electric light for night work. The whole is operated by means of a 75 horse-power engine. Thus the company has at present in operation 30 stamps capable of producing from 25 to 30 tons of concentrate, holding 50 to 53% per 24 hours.

The company also produces two qualities of crude ore, the first 48 to 50% with a small proportion of 50 to 54% ; the second from 40 to 45%. The first quality is employed for the manufacture of bichromates while the second is usually shipped to the Pittsburgh district where it is utilized in the manufacture of refractary materials.

The production for the year 1903, was 3,800 long tons, a portion of which was shipped.

No work was done in the part west of Black Lake.

American Chrome Company. This company, consisting of Messrs Beebe and Brother, of Boston, manufacturers of chrome products used in tanning leather, owns lots IV, 7, 8, 9, 10, XIII 9-B, 6, 7, 13.

These lots had been purchased from the Government in 1896, as chrome lots, by Mr. Jos. Nadeau and others of Black Lake, and previous to 1899, before they were sold to the present company, had been worked to a slight extent as follows :

On lots B, 6, 7, over a surface of from 15 to 20 acres, 7 openings were made, one being 25 feet deep and the others not more than 12, giving good indications of chrome of various grades, with thicknesses of from 1 to 9 feet, partly on lot 7. This mine was then situate 4½ miles from Chrome Siding and 80 tons were got out at the time, about 50 whereof were shipped.

On lots IV, 9, 10, situate 2½ miles from Chrome Siding, a cutting about 100 feet long by 12 x 15' was made on a hill 400 feet high, showing chrome with a thickness of from 1 to 4 feet. Other surface indications were also found. In the autumn of 1896, 185 tons were got out and conveyed to the station whence 54 tons were shipped. A choice specimen, taken by me, gave 50.76%. This mine has not been worked by the new company.

In 1899, as stated above, this property was sold to Messrs. Beebe & Co. of Boston, who manufacture under the name of "The Boston Chrome Company"; but the mining company works under the name of "The American Chrome Company". In the same year, as well as in 1900, some prospecting was done on lots B, 6 and 7. A little ore was got out but it was not shipped.

In 1901 concentrating works were put up on lot XIII, one mile from the mine and three from Chrome Siding. For the first time stamps and concentrating tables were set up where rollers and jiggers had formerly been used. The mill was built under the direction of Mr. Whitney, then manager of the company, and put in operation at the end of November, 1901. It yielded very good results and enabled experience to be gained which contributed to the establishment of other works in the region. It has continued almost constantly in operation. It consisted of a Blake crusher, 2 rollers, a battery of 5 stamps and a Wilfley table with the usual accessories. It could then turn out about 20 tons of concentrate per week and a hundred tons were obtained to the end of the year. The mill continued to work regularly in 1902 and 1903, when some improvements were made and, at the date of my visit in June, 1903, it consisted of 10 stamps, 3 Wilfley tables, one to complete the work of the first two, water being taken by means of a small pump from a neighboring stream that had been dammed, and the mill treated 18 tons yielding from 4 to 5 tons of concentrate per 10 hours; 30 men were employed in the mill and at the mine which was provided with a steam engine. In 1902, 316 tons of concentrate were obtained and, in 1903, 500 tons. The ore is of average quality, and the concentrates are shipped to Boston, where they are utilized by the company. It is proposed to transport the mill to the mine itself.

Montreal Chrome Iron Company. This property comprises lots 11, 25, 26 and III, 26, but the mine is chiefly on lot 11, 26 near the line of range III. The property was purchased from the Government in 1894 by Messrs. H. & J Leonard, D. Morin and A. Labrecque who worked it until 1902 when they organized the present company. When the mine was discovered the outcroppings were considerable and moreover the ore continued to be abundant as the excavation was deepened. Solid chromic iron was then found over a length of 60 feet and a width of 150 feet with other surface indications, 50 feet to the north-west and 100 feet to the south-east. From an opening 5 feet deep, over 100 tons of ore were taken out after a few blasts had been fired. This deposit was therefore the most important one in Colraine, but the ore is not high grade, generally yielding 40 % and sometimes reaching 44%.

During the winter of 1894-1895, the mine was worked with 5 men only and from a side-hill excavation, 50 feet wide, 20 feet long and 12 feet deep, 1,100 tons of merchantable ore were got out under exceptional conditions as regards cheapness. A few blasts would be fired, the cart would be backed up to the opening and the ore, so broken up, was handled only for the purpose of loading it. In the same season a good winter road, 6 miles long, was made with houses and stables at either end, from the mine to Chrome Siding, where the Quebec Central R. R. Company had made a siding; 600 tons were then shipped, 400 going to England.

During the winter of 1895 1896, work was continued, 960 tons being got out: then in 1896-1897, but little work was done; some hundreds of tons were nevertheless shipped, and the same was done at the end of 1897. In 1898 and 1899, 700 tons were got out, 500 of which were shipped and, altogether, down to January 1st 1900, 3,200 tons had been extracted, whereof 2,200 were shipped. Not even a derrick was used in getting out the ore and the greatest number of men employed did not exceed 15; the transporting was done in winter time only. It would have been very easy to get out still more considerable quantities; but, as the demand for this low grade ore was limited, it was deemed necessary to put up a concentrator. At the same time a company, called The Eastern Townships Chrome Mining and Milling Company, had commenced to erect custom concentration

works at Chrome Siding for the purpose of treating the ores from t
various mines of that region. That company was compelled to
into liquidation even before its buildings were completed and subs
quently Messrs. Leonard & Co. organized The Canadian Chrome Iro
Company, Limited, which afterwards assumed the name of The Mo
treal Chrome Iron Company. Some hundreds of tons were shippe
until 1902, when the aforesaid mill buildings were purchased and co
veyed to the mine itself where it had been decided to erect a concen
trator. When I visited the mine in June last, the mill was in opera
tion and consisted of a Blake crusher 20 x 6 feet, 15 stamps of 1,00
lbs, with screens of 30 meshes, 3 concentration tables, the whole con
nected by elevators and ordinary belting and worked by means of tw
boilers supplying 75 horse-power. Concentrate to the amount of 4
tons per 10 hours was turned out and the ore was conveyed to Col
raine station over a good road 7½ miles long which could be used in
summer. About twenty men were employed in the mill and at the
mine which still made a very fine showing with great thicknesses of
ore. Work was being done on the side of the hill and the ore was
sent straight from the mine to the mill. This year, the mine and
mill were in operation only from the month of April to the month of
August, and over 500 tons of concentrate were got out which were
sent to Colraine Station whence a portion was shipped.

James Reed. Dr James Reed is the owner of lot X 19½ N. W. con-
taining 250 acres and with good indications of chrome. In 1894, when
discovered, this block was divided into 11 lots, a portion of which
were leased to small groups of miners who paid a royalty of $5.00
per ton for first class and $3.00 for second class ore. Work was so
done under the names of Lemieux, Fortier, Paré and Carrier who got
out about 180 tons besides what was obtained from the mine next
mentioned.

J. Lemelin's Mine. This was the most important working on this lot
and it continued for 2 years, yielding 524 tons, 500 of which were first
class. It consisted of a cutting 200 feet long and from 24 to 30 feet deep,
at the end where the ore showed in thicknesses not exceeding 4 feet.
This mine was worked with a profit notwithstanding the high royalty
paid. It was situate at a height of 200 feet above the railway and the
ore was shipped from Chrome Siding, distant one mile.

The works on the James Reed property were abandoned in 1896,

and have not been resumed since. This ground is of importance and will most probably be opened up again some day.

Standard Asbestos Company. Work was done by this company from 1895 to 1898. It was then known under the name of the Anglo-Canadian Asbestos Company and chrome was found in the south-west part of its territory, towards lake Caribou at an altitude of 600 feet above the line of the railway ; the ore was high grade and about 1200 tons were got out, the greater portion whereof was shipped from Black Lake station, distant one mile and a half. Several excavations were made as the time, the deepest being 35 feet.

Thetford Chrome Company.—This mine is situate on the south-west part of lot A 16 and was discovered and purchased from the Government in 1899, by Messrs. Jos. Nadeau and Richard Topping, who worked it on a small scale, using horse-derricks only for extracting the ore ; nevertheless they got out 1700 tons of first class ore. In the spring of 1903, a company was organized under the above name, the members being residents of Thetford and of Black Lake.

The mine was worked throughout the summer with some fifteen men and yielded 700 tons of first class ore besides a certain quantity of tailings which may be concentrated later on. A 40 horse-power boiler is being put up as well as a steam-derrick, pumps, drills etc. The mine consists of two excavations adjoining one another and which, at the time of my visit in June, were down to 35 and 45 feet respectively with ore showing everywhere. Work was being done to clear the ground underneath to enlarge the excavations and the indications of chrome were very satisfactory. The serpentine of this region is very compact and easily worked allowing deep openings to be made ; the ground is not very high ; the ore found is very remarkable and of high grade ; a specimen taken by me gave 56.20 %.

The mine is about five miles from Black Lake but, before reaching the good part of Poudrier road, there are 2½ miles of bad road which cannot be used for summer traffic. Shipments can be made *via* Black Lake or Thetford stations.

Star Chrome Co. This company has been recently organized to work on lot XIII 4 to 8 of the Indian reserve on which good indications of chrome have been found and it intends to work this year.

Other mines in Colraine. In addition to the minesabove mentio
the following lots may be mentioned on which chrome has b
found and mined for to a slight extent.

XIII. 8.—(Indian Reserve),—worked in 1894-1895, by R. Topp
who got out fifty tons of good grade and these were shipped. T
mine was then supposed to be on lot 9 of the same range.

IV. 25.—Nayes mine.—was worked to a slight extent in 1895 a
produced 25 tons of good ore which were shipped.

B. 23.—Contains a rather considerable deposit of low grade o
about 40 tons of which were got out by Mr. Blondeau in 1897.

II. 22.—Ore has been found on this lot but no work has bee
done.

III. 25.—Mr. A. Boudreau prospected on this lot on which a littl
chrome appears.

A. 17.—This lot was prospected in 1900 by Messrs. A. Carrier and
others and a few tons were got out : the indications are good and
further work would be justified.

B. 26.—Was worked in 1898 by Mr. P. P. Hall and a certain
quantity of good ore was got out. Pretty large masses of low grade
ore were also observed. On this lot there is also chrome in the shape
of sand but it has not been established whether it exists in large
quantities. This property is worth being further developed.

I have mentioned the lots in Colraine on which chrome has been
found : but prospecting has been done on others which presented
indications of ore, in particular Nos A 15, B 13, XIII 5. On lot XIII 2
ore is found mixed with magnetic iron.

It is moreover probable that chromic iron will be found on other
lots in this township which have not yet been sufficiently prospected.

Chromic iron has also been found in other townships as follows :

Bolton.—In 1896-1897, 27 tons of good grade were got out of lot
VII 9 and shipped to Liverpool. A specimen taken by me gave 49 %

of sesquioxyde. In this township serpentine covers a rather large surface : it has a fine appearance and would justify the performance of further work. This mine is 4 miles from Eastman on the Canadian Pacific R. R.

Good indications have also been found with a thickness of 2 feet on lot 23 and others on lots 13 and 26½ west of the same range as well as on lots IV 13 and VI 26.

Brompton.—On lot IX 26, near lake Brompton, Mr. J. McCaw did some work and got out some chrome from a depth of 4 feet, the shaft having been started to prospect for asbestos, and a dozen tons were shipped. An analysis gave 51.16 %.

Melbourne.—The Geological Survey mentions chrome found on lot VI. 22 with a thickness of 9 inches, but it has not been worked.

South Ham.—In 1861, Mr. R. Leckie got on lot 11.4 about ten tons of ore from a deposit with a thickness of from 3 to 4 feet. According to the Geological Survey this ore contained a proportion of 43.9 % and was carted to Arthabaska on the Grand Trunk Railway. Deposits of chromic iron have also been found on lots II. 20, 21, as well as on lot 27 east of the Gosford road range.

On lot 1 W. ½ 21, Dr. James Reed discovered a rather remarkable deposit which, although not precisely of chromic iron ore, may be mentioned in this chapter. It consists of a vein of magnetic iron in contact with the serpentine and pre-cambrian schists of the region and was observed in a north-westerly direction for a distance of 200 feet with thicknesses of from 6 to 13 feet and a vertical dip. A shaft 12 feet deep shows a thickness of 9 feet at the bottom. An analysis of this magnetic iron gave 4 % of sesquioxyde of chrome and a little copper which manifests itself by a coating of carbonate of copper covering the ore. From this hole about one hundred tons were got out, samples only of which were shipped. I cannot say anything about the special importance this ore may possess, but this blending of iron, copper and chrome is interesting, and deeper excavations might establish the predominance of one of them and cause work to be undertaken.

The natural outlet of the South Ham mines is by Garthby station on the Quebec Central R. R., distant 10 or 12 miles.

Ireland.—In the south-east part, not far from the line of Colraine fine indications of good grade chrome are found on the property of the King Brothers Company, especially in ranges II and III. In 189 about 50 tons were obtained from lot II. 28. Other prospects have since been made, but no regular work has been carried on. Work was also done last autumn and some good ore was got which will be shipped *viâ* Colraine station. In a previous chapter I have given complete analyses of these ores.

Leeds.—In 1887, Dr. James Reed got out 54 tons of ore containing 51.52 % which was shipped to Philadelphia. Serpentine has been worked to a slight extent only in this township, and after this pocket was exhausted, it did not seem profitable to undertake other works. This mine is about 12 miles from Robertson Station on the Quebec Central R. R.

Thetford.—Dr. James Reed got out some tons of ore from lot IV. 16, but it is low grade and does not seem very abundant.

Wolfestown.—About 1886 some thirty tons were got out of lot III. 34. Prospecting was also done on the neighboring lots : II. 24, III. 23. 25, IV. 26, and good indications of chrome were found which were followed for a distance of 600 feet with varying thicknesses, ranging from 3 to 5 feet. This district presents good indications and is only 5 miles distant from Colraine on the Quebec Central Railway. It would therefore be worth developing but the companies owning these lands have devoted their efforts chiefly to searching for asbestos and have not as yet deemed it advisable to mine for chromic iron.

Garthby.—This township has some important deposits which were worked to a slight extent until 1898 but not since.

In the neighborhood of Breeches Lake, Mr. H. Leonard worked on lot 1 C in 1894, and got out 400 tons of ore, probably of the highest grade obtained in that region, some car loads having given 55 %. The ore is very friable and a portion had to be shipped in bags. The work was done without the aid of machinery and with a few men only ; the ground was rather liable to fall in and was low while the water was also a serious drawback. The same owner, with others, also acquired the portion of lots II. 5, 6, 7 and 8 north of Indian Lake, where good

indications had been found. In 1886 some work was done on lots 6 and 7 from which about thirty tons were got out and shipped.

Mr. Gosselin also did some prospecting on lot 1 B, but no ore was shipped.

In the same region chromic iron has also been found on a small island in Breeches Lake, but this deposit has not been worked.

This district is an important one and will probably be developed some day on a larger scale; it is situate about 9 miles from D'Israeli on the Quebec Central R. R.

Chromic iron of a different kind has likewise been found in another part of the same township. The ore is very hard and compact and gives an average percentage of 40 %; some assays however gave as much as 44 %. A trial of concentration of this ore showed that contrates could be obtained containing a percentage as high as 51 % but it has to be crushed very small. The ore is very abundant.

On lots V 36, 37, situate two miles north east of d'Israeli, a very considerable deposit has been found which, about 1897, was worked to a slight extent by Mr. O. Brousseau : at the time 35 tons were got out and shipped.

Gaspesia. In Gaspesia there is a great mass of serpentine, forming Mount Albert which has an altitude of 3,700 feet, at the head of the river Ste Anne des Monts. This mountain was pointed out long ago by the Geological Survey as containing chromic iron. I made an exploration in the summer of 1897 and particularly examined the plateau forming the summit which presents a surface of not less than 25 square miles completely bare of vegetation, the rock being fully exposed everywhere. In fact I found some pieces of chromic iron and even some small veins from 2 to 3 inches thick, but I saw nothing to justify work being done. There is a strip of black and heavy hornblende which may have been taken for iron by inexperienced explorers. This region is, moreover, difficult of access, being situate 35 miles from the Gulf of Saint-Lawrence, the only way to it being by the river Saint-Anne which is itself not easy to ascend, to say nothing of the height of the mountain.

CONCENTRATION

A portion of the chromic ores of the Eastern Townships is hig grade, others are poorer either owing to their chemical compositio or their more or less intimate blending with the serpentine. In addition in each mine, either in the blasting or in the hand-picking, there is proportion of low grade debris.

Now there is a profitable market for this ore when the percentag of sesquioxyde of chrome is in the neighborhood of 50%. Therefore, a the ontset of the industry, the importance of the effect of concentra tion on its success was felt. In my report for 1898, I mentioned th trials made at the works of Edward P. Allis and Company, i Milwankee with the Castelnau concentrator, under the patronage of the Government of the province. The works consisted of a Blake crusher, a Bayley grinder and a Castelnau table. On issuing from the grinder the ore passed through a screen of 20 meshes fo difficult ores and through one of 18 meshes for those that were easily concentrated.

I consider it unnecessary to give a description of these apparatus or of those to which I shall refer later on as this can be found in tech- nical works and in the catalogues of the companies that make them.

The experiments at Milwankee gave the following results :

Crude ore		Concentrated ore :	
40 16	per cent	51 12	per cent
40 64	" "	42 94	" "
34 88	" "	49 42	" "
39 58	" "	48 89	" "
42 01	" "	42 66	" "
28 68	" "	45 70	" "
38 34	" "	48 90	" "
37 24	" "	56 28	" "
40 76	" "	60 66	" "

I chose the poorest ores or the refuse of the mines for the experi- ments which were made on lots of from one to two tons. Now it will be observed that concentration was unsatisfactory in the case of two

samples only, and I even think that those two results are due to special causes independent of quality.

The circumstances under which the experiment was made did not allow of my ascertaining the yield of the concentrator, but it was established that, practically, our chrome ores were susceptible of being advantageously concentrated and that the cost of getting a ton of concentrate of 50 % with ore of 40 % did not exceed $3.30, leaving a sufficient margin of profit. Moreover, a specification made out at the time by the Allis company showed that concentration works could be put up for the production, on those bases, of ten tons of concentrate per 10 hours at a cost of $15,000.00.

Owing to the distance, it did not seem practicable to accept the offer of the Allis Company and the Colraine Mining Company gave the contract for the erection of a concentrator to the Jenckes Company of Sherbrooke. It was deemed preferable to not adopt the system of tables for concentration but to use jiggers. The mill was built on the shore of Black Lake below the line of the Quebec Central R. R. and it was put in operation at the end of 1898. It consisted of two Blake crushers, the first of which was followed by a table for hand sorting, reducing the dimensions of the pieces to 2½ inches and then to one inch when they passed between two rollers making 175 revolutions to the minute. The ore so ground passed through a Cromwell sorter or revolving perforated cylinder ; what came out of it was fed to a jigger with three compartments striking 150 times to the minute with an average dropping of two inches, the concentrated ore being removed at the base by a stream of water. A pump raised the water from the lake and the various apparatus were connected by elevators or bucket chains and ordinary belting, the whole being operated by a 75 horse-power steam engine. The works ran experimentally to the end of 1898 when it was deemed advisable to make some alterations ; then the electric light and a cylindrical drier were put in. At the beginning of 1899 they were again put in operation and treated 30 tons of debris per 20 hours, 8 men being employed.

A certain quantity of good concentrate was thus obtained but the tailings carried away a great deal of fine ore and the yield does not appear to have been satisfactory.

Between times two other batteries of jiggers and settling tanks for fine ore were added.

In 1901, Mr. Whitney, manager of the American Chrome Compa
after some trials, put up a concentrator on an entirely different p
The ore was crushed and conveyed to a stamp mill with a screen o
holes to the inch and the ore so crushed fell directly on a Wilfley t
where the concentration was effected. This system worked well
as it was found the most suitable for the treatment of chrome ore
has since been adopted by other companies. The concentrate obtai
contains the proper percentage and the tailings do not retain m
than 1 to 2% of sesquioxyde of chrome.

As the Colraine company had transferred its property to
present company, the latter transformed the Black Lake mill, do
away with the jiggers and rollers and replacing them by stam
and by Wilfley tables. It was found also that the drying of t
concentrates was unnecessary and that in the wet state, containi
about 5% of water, it was easier for the producers to handle them a
for the transportation companies which accept them without chargi
for the moisture.

The Black Lake Chrome and Asbestos Company has added
stamps to its lower mill and has put up a 10 stamp mill at La
Caribou, being guided by the experience they had gained.

The Montreal Chrome Company has put up a 15 stamp mill
St. Francis, so that with the 10 stamps of the American Compan
there are in Colraine township 4 mills, representing 55 stamps.

The operators are, moreover, striving to perfect the system bu
in reality, it is very satisfactory, economical and easy to operate.

WORKING, TRANSPORTATION AND LABOR

As chromic iron is found only in pockets of very variable dimen
sions, it is hardly possible to have plants on a large scale installed with
the view of working for a long time and hitherto, with the exception o
the Caribou shaft, the operations have been confined to working i
quarries, setting up steam engines, when necessary, in temporary
buildings which could easily be removed. In all the small working
above mentioned, h[illegible]-derricks were used and work was done by
hand, while at prese[illegible] steam is used in the more important workings
The nature of the serpent[illegible], either in masses separated by sliding

planes, or in the form of schistous rock, liable to fall in, is also an obstacle to regular underground work, and it is probable that, for a few years to come, work will be continued in open cuttings with small pits on a small scale, concentrators being put up near the more important deposits. Owing to the altitude of these deposits there is little water in the mines and no timbering to any great extent is needed except when underground work is carried on.

The mines are situate within a distance of a few hundred yards or a few miles from the railway, the furthest being 7 miles away; transport can be effected at any season but, in the case of the distant mines, it is easier in winter, the cost varying from 25 cents to $2.00 per ton. The total price of extraction and transport varies between the two extremes of $1.00 and $8.00. Hand-sorting is resorted to only in the case of high grade ores and the cost of concentration varies according to the proportion contained in the tailings.

Some mines have given out the work by contract, paying $5.00 per ton of ore delivered at the railway.

Labor costs from $1.00 to $1.25 per day of 10 hours for ordinary wood men and from $1.25 to $2.00 for skilled workmen and foremen.

QUANTITIES (IN LONG TONS) OF CHROMIC IRON PRODUCED AND SHIPPED

Previous to 1894 (Leeds and South Ham)	64	tons	worth	$ 1,920
1894	915	"		18,300
1895	2837	"		51,066
1896	2037	"		36,666
1897	2340	"		32,770
1898	1805	"		25,000
1899	1768	"		20,867
1900 (1st class)	1224	"		
(2nd class)	844	"	2068	24,434 / 9,015
1901 (1st class). Concentrate and crude	592	"	1274	9,424 / 7,820
(2nd class)	682	"		
1902 (1st class)	900	"		13,000
1903 concentrate and crude	3020	"		45,300
Total	19,028			295,582

In the year 1902, the United States produced only 315 long tons o chromic iron worth $4,725.00 at the mine and coming from California The imports for the same year amounted to 39.570 tons worth $582, 597.00. The consumption was therefore 39,885 tons, worth $587,322.00 while in 1898 it was 16,404 tons worth $273,234.00 that is to say it has more than doubled in that period of 5 years.

The following figures for 1902 give an idea of the product exported from other countries.

Canada	1159	metric tons
Greece	4580	" "
New Caledonia	17451	" "
New South Wales	2523	" "
Turkey in Europe and in Asia	40972	" "
United States	506	" "
	67191	" "

These figures do not include the product of Austria, Norway and Russia which represents several thousand tons. It will thus be seen that the consumption for the whole world in 1902 was 80,000 tons. These figures are taken from the *Mineral Industry* of New York which publishes the most complete and most accurate data on the mining industry generally.

USES

The chief use to which chromic iron is put is the manufacture of bichromate of potash and of soda which serve as a basis for the chrome colors so generally used in dying and printing stuffs. For some years it has been successfully used in tanning leather, its effect being much quicker than that of vegetable tannin. It is also used in chemistry and in medicine. It serves as the basis of *ferro-chrome* used in making chrome iron and steel possessing special properties, amongst others that of great hardness which causes them to be much sought after for armor-clad ships and forts, heads of shells, dies and shoes of stamps, tools for working iron, safes, etc. The percentage of ferro-chrome varies, but that manufactured in the Province of Quebec contains over 60 % of chrome : chrome steel may contain from 1 to 10 % according

to the use made of it. Chrome imparts a great hardness to steel as well as unalterability, while increasing its elasticity.

Ferro-chrome containing over 60 % metallic chrome is manufactured in Canada by the Electric Reduction Company, Limited, of Buckingham, P. Q., which yearly uses some hundreds of tons of Colraine ore.

Some companies in Europe are also making metallic chrome used for special purposes.

MANUFACTURE OF BI-CHROMATES

The principle of this manufacture consists in heating in a reverberatory furnace the pulverized ore mixed with a salt of potash or of soda (carbonate or sulphate) and with unslacked lime, the object of the latter being to divide the mass and prevent its becoming solid. Chromic acid is formed in the oxydizing flame of the furnace and it forms a chromate with the potash. The product is then treated with hot water which dissolves the chromate; the liquid is then concentrated by heating it and sulphuric acid is added which causes the formation of bi-chromate and sulphate of potash. It is then allowed to crystallize and crystals of bi-chromate of potash are obtained; the liquid containing the sulphate of potash is treated to allow of that salt being again used.

The treatment for bi-chromate of soda is the same but, as that salt is deliquescent, that is to say it readily absorbs water from the atmosphere and does not crystallize in the same way, the end of the operation is modified accordingly. This summary gives the general idea of the operations to be gone through but the work is a very delicate one owing to the proportion of the various materials used, the management of the furnaces, the temperature, filtering and crystallizing of the liquids, the proportions of the water and re-agents, acids, etc. The scope of this work does not allow of my entering into more details on this point but I wish to call attention to the reasons which lead high grade products to be desired in this industry in which ores containing less than 50 % cannot be used. The chromic iron is crystallized apart so as to pass through a screen of 80 meshes and is mixed with a certain proportion of carbonate or sulphate of potash (a costly product) and of lime. Care should be taken to transform, in a single operation, either the whole or the greater portion of the chrome and as the cost of the fuel and labor as well as that of the

subsequent operations is the same, it will be seen that the profit will be in proportion to the quantity of useful material obtained, hence the reason for having the richest raw material and one best adapted for treatment.

This industry is a complex one : many paterts have been taken out in connection with it and each factory has certain processes which it keeps secret. In any case it requires much practice, and great skill both as regards the workmen and the persons in charge.

The consumption of bi-chromate is rather considerable and, during the past years, its price has remained very uniform at 10½ cents a pound. I am not prepared to state what the consumption of this product is in Canada, but, for the reasons given above, I do not think the time has yet come when its manufacture should be encouraged.

USE OF CHROME IN THE CONSTRUCTION OF METALLURGICAL FURNACES

Owing to its infusibility and to the difficulty of reducing it, the natural chrome ore has been used for the past ten years in lining the inside of blast and reverbatory furnaces employed in the metallurgy of copper and lead and it is now in current use in Europe and America, where this industry has become an important consumer of chrome ore. It should also be noted that ore containing 45 % is sufficient for this purpose and that the ore is used in its natural state as building stones, the filling in being done with a mortar consisting of small pieces.

Refractary chrome bricks are also made and those of the best quality consist exclusively of chrome ore, while in others of less value the agglomeration is made with lime, clay, bauxite, plaster, etc.

For some years past our ore has found a profitable market for such purposes in the Pittsburgh region where several companies make these bricks.

MARKET

Since the beginning of this industry prices have fallen regularly notwithstanding the increased demands which moreover gave rise to the

working of new deposits, causing a relatively considerable production for some countries, such as Turkey and New Caledonia, and this production seems even to have been excessive for the last years and to have brought about a fall in the normal price. It is probable, however, that if foreign producers wish to make a profit they will regulate the prices, for our shipping facilities can hardly be surpassed.

Ten years ago the chromic iron of this province sold for $20 to $21 per long ton. F. O B., on the Quebec Central RR., for 50 % ore with an increase of 50 cents per unit. The price fell to $18 and last year to $15. But it is probable that $18 will remain the average price for 50 %, $12 to $14 for 45 % ore and $8 to $10 for 40 % ore. I would observe that the high grades are chiefly in demand and that, as a rule, the same price is paid for concentrated ore as for that in lumps.

There are no duties on chromic iron in the United States, but there is one of $4 per ton on ferro-chrome and other products of chrome. The freight on the ore from Black Lake to Baltimore, Philadelphia and Pittsburgh is about $5 per ton.

We have no information regarding the European market, but, according to the applications that have come to us, I understand that our high grade ores would sell there if the freight were not too high

The following companies buy chrome ore :

In Canada :—

The Electric Reduction Company, Ltd., Buckingham, P. Q.

In the United States :—

Baltimore Chrome Works, Baltimore ;

Kalion Chemical Company, Philadelphia ;

Beebe & Company, Boston, Mass. ;

Chrome Steel Works, Brooklyn, N. Y. ;

Fayette Manufacturing Company, Chester, Pa. ;

Harbison Walker Company, Pittsburgh, Pa.

There are also a good many other consumers whose address is unknown to us.

In England :—

Stevenson, Carlyle & Company, Glasgow ;

J. & J. White, Glasgow ;

Geo. G. Blackwell, Sons & Company, Ltd, Liverpool.

I give below the names of the companies that produce chrome or are capable of producing it in the province with the address of their representatives :

Black Lake Chrome and Asbestos Company, 1724 Notre Dame street, Montreal ;

Montreal Chrome Iron Company, Room 70, Canada Life Building, Montreal ;

American Chrome Co., Blake Lake, P. Q. ;

Thetford Chrome Co., Thetford, Mines, P. Q ;

King Bros Co., Ltd, Union Bank Building, Quebec ;

The Standard Asbestos Co. Ltd, R. 58, Canada Life Building, Montreal.

Star Chrome Mining Co., 66, St. James str., Montreal.

LEGISLATION

The mines belong to the Crown ;

1. On all lots not yet sold ;

2. On all lots sold and patented for farming purposes since the 24th July, 1880, the owner of the surface having absolutely no rights, except for damages that may be caused by the working of the mines, and which are assessed by arbitration, according to articles 1466 and following of the Mining Law.

The whole township of Colraine is reserved for mines and the lots, which are about 100 acres, cannot be sold for other purposes except on a special report of the Inspector of Mines.

Prospecting permits, good for three months, can be obtained at the price of $5 per lot of one hundred acres giving the bearer the privilege of purchasing.

Mining permits are also granted at the rate of $5 each and a yearly rent of $1 per acre, renewable on payment of the aforesaid fee. The law defines no minimum for surface but only a maximum of 200 acres.

These latter permits are renewable indefinitely. For the purchase of the lots themselves, the price for chrome in that region is $4 per acre conveying the ownership of the surface and the right of mining. The law fixes a minimum of 100 acres (one lot) and a maximum of 400 acres for one individual or 1000 acres for a company. Application must be made to the Government and be accompanied by the required fees and by specimens. The patent or final title is granted only after a sum of $200 has been spent within two years.

On lots under timber licenses, the holders of such licenses are allowed three years to remove the merchantable timber.

MAP

The map accompanying this work must be looked upon rather as a diagram indicating the lands that still belong to the Crown ; nearly the entire portion included in it is covered with serpentine and with the encasing diorite. The roads indicated are partly made for the service of the mines, some being fit for use in summer time. The road between Black Lake and D'Israeli is good in winter and fairly passable in summer as far as Colraine : that from Black Lake to Thetford is good at all times ; the Poudrier road is an old Government road abandoned long ago and on which a narrow path alone remains. The country is mountainous and the reliefs are indicated in an imperfect manner only. The highest points are near the little lake north-west of Lake Caribou and on the western corner of Block A, 809 feet above Black Lake. Black Lake station is 160 feet above the same level and Lake Caribou 215 feet. Adstock mountain is 1800 feet high.

Colraine station is 869 feet above sea level; that of Black Lake 940 feet and that of Thetford 1026 feet. The distance from Black Lake to Levis is 80 miles and to Sherbrooke, 63 miles. The whole township of Colraine is unfit for cultivation ; there remains pratically no merchantable timber on it and in a few parts only is there wood suitable for fuel.

HISTORY

For a long while chromic iron was looked upon merely as a mineralogical curiosity and its industrial use came only when it was applied to chemical industries.

The use of chrome salts for dyeing date from 1820 and the manufacture of bi-chromate of potash began at about the same period. It was not until 1883 that potash was partly replaced by soda. Until 1827 the region of the Ural Mountains supplied the needs of the very limited consumption of that product. In 1827 chromic iron was discovered by Mr. Isaac Tyson, junior, in the neighborhood of Baltimore and after some searching it was also found in other parts of Maryland and in Pennsylvania. From that date to 1862 the Baltimore region supplied the chrome market in the United States and in Europe. In the latter continent the most important centre of consumption at that date was Glasgow. In 1845 Mr. Tyson, with the view of utilizing his surplus products, established a manufactory of bi-chromate of potash which is still in operation in Baltimore, under his direction. In 1848 the deposits of Asia Minor were discovered and about ten years after they became the most important factor in the production of chrome, we may say, in the whole world. In 1869 this ore was discovered in California and supplied the American manufactories from 1878 until late years; then in New South Wales, in New Caledonia and finally in Canada and Newfoundland in 1894.

The Philadelphia manufactory was established in 1880 by Messrs. Harrison Brothers.

The consumption of chromic iron has considerably increased in consequence of the new uses to which it is put, such as the employment of chromic acid for tanning leather, the manufacture of ferro-chrome used in the metallurgy of iron and steel, the preparation of refractary bricks with the ore itself. In the United States alone the consumption, which was 12,000 tons in 1897, has gradually increased to 40,000 tons in 1902. I may add that the total production of chrome ore represents 80,000 tons, whereof 40,000 were supplied in 1902 by Turkey, the other chief producing countries being New Caledonia, Australia, Russia and Greece respecting which I will give some information further on. I would also observe that, in all those countries, chrome has been found with serpentine.

COUNTRIES PRODUCING CHROMIC IRON

I give below some information respecting the other countries that produce chrome. It is taken from memoranda or from special publications but is fully summarized in the various volumes of the

"Mineral Industry" of New York, which also gives very interesting details regarding the manufacture of bi-chromates and of ferro-chrome, the concentration of the ores, their analysis, etc.

UNITED STATES

Pennsylvania and Maryland

These two states were for a long time very important producers of chromic iron, which was first discovered in the county of Hartford (Maryland), and the Reed property worked by Mr. Tyson became one of the most remarkable mines of that ore, having yielded over a hundred thousand tons. A remarkable fact is that this mine shows no outcropping, the workable deposit having been found at a depth of 8 feet. In the same region ore was found near Baltimore in the form of sand, which was concentrated without difficulty. Subsequent searches led to the discovery, in the county of Lancaster, in Pennsylvania, of the Hood mine, which likewise became the property of Mr. Tyson. This mine was worked regularly from 1828 to 1880, except from 1868 to 1873, and yielded a quantity which, in 1880, was estimated at 95,000 tons. During the last years, the yearly production was a few hundred tons only. The depth attained was 700 feet and the mine was worked by regular levels.

Other mines of less importance were also worked in the same regions, and I refer to a remarkable paper by Mr. W. Glenn, of the Baltimore Chrome Works, which contains a complete history of this industry (Transactions of the American Institute of Mining Engineers, October, 1895), and also to the "United States Geological Survey, Chromic iron, with reference to its occurrence in Canada," by the same author. These mines are no longer worked.

Chromic iron is also stated to have been found in Virginia, in North-Carolina and Vermont, but I am not aware that it has been mined continously.

California

In the mountains of Santa Lucia in the north-western portion of the county of San Luis Obispo and in other adjacent counties, numerous deposits of chromic iron are found which are frequently of low grade and silicious. These mines were discovered in 1869, and the manu-

facturing companies of Baltimore and Philadelphia acquired the control of several of them. Since 1878, these mines have been worked pretty regularly and have yielded an average of 2000 tons per annum until late years, representing a total of about 36,000 tons. Trials have been made in connection with enriching which seem to have had fair results, the proportion of some of these ores being carried to 50 %. Difficulties of transport and long distances to the point of consumption seem, however, to have had an effect on the development of this industry for the production has gradually fallen off and of late years has been nil or of a few hundred tons only (315 tons in 1902).

NEWFOUNDLAND

Chrome is found on the west coast of Newfoundland at Bluff Head, Port au Port Bay, where a very important deposit has been worked by the Halifax Chrome Company (Transactions of the American Institute of Mining Engineers, Geo. W. Maynard, February, 1897). The author of this paper says that this ore yields from 39 to 50 per cent and he mentions a mass discovered which was 97 feet long by 45 feet wide. I visited this mine in 1894 before it was opened and ascertained the value of the deposit, which can be worked to advantage if means can be found to ship it easily. The mine was worked from 1896 to 1899 and, during that period, yielded 5,500 tons of ore. Concentration works were put up but working has been stopped for several years.

TURKEY, ASIA MINOR AND SYRIA.

Chromic iron was discovered in 1846 in the vicinity of Brusa and in other places in the neighborhood but at present the chief mining centres are further south, the shipping ports being Makri, near Smyrna, and Ghemlek, near Brusa, the ore being transported a rather considerable distance by means of camels. These mines have been worked regularly only since 1855 and from that date they have been the chief sources of the chrome used in Europe and in America. The ore that comes to the United States is high grade and of very good quality, containing from 50 to 54 per cent.

Some has also been found and worked near Antioch and Alexandretta in Syria.

The most important deposits, however, seem to be those of the district of Brusa which, owing to the cheapness of labor and their high grade, can be mined and transported profitably.

MACEDONIA

High grade ore is mined in this province near Monastir and Kossovo, the port of shipment being Salonica. The quantity shipped amounts to several thousand tons a year. We have but little information regarding that country.

All the mines have been considerably developed and the shipment which amounts to some ten thousand tons a few years ago, has reached the figure of 40,000 tons, 12,000 coming from Turkey in Europe, and 28,000 from Turkey in Asia.

GREECE

Chrome is regularly mined in that contry, especially in the region of Thessaly and the yield has increased from a few hundred tons in 1897 to several thousand in 1902 when the shipment was 10,750 tons. The ore does not seem very high grade.

NEW SOUTH WALES, AUSTRALIA

This ore has been mined there since 1882 and attempts were then made to export it but the mines were not developed until about 1892 and they became of importance in 1894 for we find, for that year, an export of 3034 tons of a value of £12,336, the total quantity taken out until 1895 having been 4525 tons for seven mines, the most important of which gave 1230 tons. The ore was shipped from Sydney to England, the cost price at Sydney varying from $6 to $9. The ore seemed high grade and the deposits abundant. The districts where mining is carried on are those of Gundagai and Tumut. The ore seems good grade but, the mines are rather far from the railways and the shipment has varied from 2000 to 5000 tons of late years.

NEW ZEALAND

Deposits have been found which were worked to a slight extent, from 1858 to 1866, yielding from 5,000 to 6,000 tons of ore which was seemingly of high grade. At present practically none is got out.

NORWAY

Small quantities of chromic iron were discovered in the vicinity of Drontheim and Roeraas; mining to a slight extent was carried on, the shipments never exceeding 400 tons per annum and they seem to continue on the same small scale.

AUSTRIA

There are rich ores in Bosnia but they are often much mixed with the rock and are concentrated by simple washings after being crushed. The production is some hundred tons a year; in 1894 it was 1808 tons. Chrome is also found in Moravia, Styria and Hungary but of lesser importance.

NEW CALEDONIA

New Caledonia seems particularly rich in chromic iron which has been mined there since 1875 and during the past six years the shipments have amounted to from 10,000 to 18,000 tons of high grade chrome. Some poorer ore has also been found in that colony, but it has not been found advisable to mine it. The ore appears in the alluvial form or in rocks: the former is in grains, is easy to extract and must be washed before being shipped: the other is picked by hand. There is no mechanical concentration and some difficulty is experienced in conveying the ore to the shipping points, but, as the various mining companies have formed a syndicate under the name of "Société de Chrome" a greater development of these mines may be expected in consequence of the building of a railway and the probable employment of mechanical means of concentration. That colony is no doubt destined to be a great producer of chrome.

RUSSIA

Chromic iron has long been known to exist in the Ural Mountains and the Caucasus; until 1877, that country exported its products but recently a manufactory of bi-chromate was established near Elabongi which a few years ago consumed 2,000 tons per annum. Those mines are important producers, the yield having reached some twenty thousand tons, but I understand that hardly any ore is exported.

In addition to the countries above mentioned, Silesia may be cited where ores of inferior grade have been found and the mining of which has been abandoned. Some has likewise been found in Hungary and Cuba while in Tasmania are iron ores containing merely some units of chrome.

COPPER

The Eustis and Nichols mines, at Capelton, were worked with results similar to those obtained in previous years, yielding 23,644 long tons of ore worth $109,875 at the mine, out of which 14,770 tons were shipped to the United States while 8,874 tons were treated for sulphuric acid at the Nichols' Chemical Company's works in Capelton. This company also prepares other products as well as chemical fertilizers and also obtains mattes which are exported. The manufacture of fertilizers was recently transferred to the Capelton Chemical and Fertilizer Company of which we shall speak in the chapter on phosphate and which uses the apatites of the Ottawa region.

Those two mines were in operation throughout the year and employed 300 workmen. The Eustis Company is putting in an electric plant which will be finished this summer. The power is supplied by falls on the little river Coaticooke two miles distant from the mine which has been dammed. It will supply 450 horse-power for the use of the mine and this force can be increased. The plans of the mine will be changed and so will that of the shafts which will be replaced by a single double track shaft which may be used for conveying the workmen. This new electric plant must be looked upon as a great progress in the mining industry of our province and it is probable that the yield of the Eustis mine will be greatly increased in consequence.

A great deal has been said in Sherbrooke with reference to putting up works for sampling and smelting mattes of the copper ores of the region and a company is being formed for that purpose under the name of The Eastern Townships Smelting Company. Its object is to smelt ore from the various mines which until now have produced but small quantities because the variable composition of those ores makes it more difficult to utilize them. The system proposed to be adopted is that of "pyritic smelting" in which the sulphur of the pyrites is used for combustion. It is successfully employed in the United States and allows of concentrating in the matte the greater portion of the gold

and silver contained in ores considered as refractary with other processes. To feed a first furnace of a capacity of 60 tons per day, it is proposed to use the ore from the Memphremagog mine which can easily supply that quantity.

Without entering into the details of the technical and financial organization of that project, I will merely mention the following :

In the Eastern Townships there are a great many mines formerly opened and some fresh prospects showing a certain variety of ores. It is difficult to find a market for these in the United States owing to their low grade and the small quantities produced. Operators on a small scale have thus no chance of developing their mines, but with a near market, the smallest quantities of ore could be sold and paid for at once by certificates discountable at the banks. This would be a great encouragement to them and help towards making new discoveries. I think therefore, that such an undertaking should be encouraged and, if well managed, it should not fail to have a considerable effect on the development of the mining industry in the Eastern Townships.

No other work was done in the copper mines of the Sherbrooke region beyond some searches and prospects in the Ascot, King, Suffield, Silver Star, Memphremogog and Harvey Hill mines ; a couple of tons have been sent from the latter to the St. Louis Exhibition as samples.

MATANE MINE

In my report for last year I gave the situation of this property. I visited it since, in August last. The main shaft, known as shaft No. 3, had been sunk to a depth of 166 feet and at the level of 114 feet, cross-cutting drifts have been cut which have established the following :

In this region there is a belt of blackish calcite turning to white where the crystallization is more developed ; the dark color seems due to a mixture with some coaly substance. It seems to have a north-west south-easterly direction and a variable dip towards the north-east ; it is comprised in the diorite proper, accompanied by a schistous formation but slightly developed. This belt of limestone has not been completely crossed by the cross-cutting drifts and is shown on the surface only by shaft No. 1 on the left bank of the Gagnon brook.

It holds, disseminated through its mass, copper ores of the chalcopyrite and bornite variety, carrying several ounces of silver and an appreciable proportion of gold. Further, I was shown certificates of assays made by Mr. Hersey on certain specimens which appear to have given considerable percentages of gold with heavy proportions of silver. The parties working this mine seem to have met with these specimens only in a very irregular fashion, for I could procure none at the mine, and the origin of these rich parts is still an unsolved problem. I should mention, however, that a specimen of bornite coming from this mine was handed to me by Mr. H. N. Gourdeau, of Quebec, who took it himself from the mine, and which I had Mr. Hersey to assay with the following results : The ore was a small piece of blackish calcite, very similar to the one I saw at the mine, which held 47.50 of bornite. The assay of the whole specimen showed per ton :

Gold	1 ounce 20
Silver	4 " 48
Copper	32.6 per cent

The concentrate or 47.50 % of pure bornite would thus contain :

Gold	2 ounces 52
Silver	9 " 43
Copper	68.4 per cent.

The proportion of copper is higher than that given by Dr. B. J. Harrington (Formula of Bornite) 63.55 %, but that may be due to the mixture of a little chalcocite or cuprite in the ore.

An assay was also made by Mr. Hersey, on the same ore, but probably almost pure, sent to him by Mr. Gourdeau, with the following results :

Gold	2 ounces 32
Silver	8 " 18
Copper	64.57 per cent.

These results are concordant and I conclude from them that there really exists in this mine parts rich in gold which seems to be present

with the copper ore, the high percentage of gold being due probably to the presence of some special mineral yet unidentified.

When I visited this mine in August last, I took in the drifts at the 114 feet level several specimens which assayed respectively 4.97-2.86 and 3.85% of copper, the ore being chalcopyrite with a little bornite in calcite or compact limestone. Specimen No. 2 contained 0 ounce. 06 of gold equivalent to $1.20 per ton and showed a little bornite mixed with the chalcopyrite, the proportion of silver being insignificant. The pure part of this specimen might therefore contain some fifteen dollars of gold to the ton.

The drifts in this level represented 37 feet to the north and 37 feet to the south, or 74 feet in the limestone presumably across the limestone belt and 30 feet in the direction of that belt. The whole of this mass showed ores disseminated in a manner analogous to the three specimens above mentioned. Since my visit, the drifts have been transversely extended to 90 feet in the limestone, while the belt of the latter has been followed for 125 feet. The shaft was then 166 feet deep and has not been sunk lower. The limestone was struck in the shaft at a depth of 70 feet, at a point which might be considered the hanging wall, while in the cross cut to the south, what appeared also to be the hanging wall was met with, these two zones being characterized by large stones of diorite rounded, but flattened and of symmetrical form, analogous to such as might be formed by stones worn through turning in round holes.

In order to ascertain the formation and the thickness of the limestone belt, the company has installed on the other side of the Gagnon brook a diamond drill of 1½ inch supplied by the Standard Diamond Co., which, in a first boring to the north of the vein and at an inclination of 64 degrees from the vertical, reached 640 feet without striking the limestone. Another boring at 400 feet from the first and to the south of the vein, had reached 445 feet on 1st April, 1904, and has not been continued since. These two borings met with a series of rocks, which seem to be connected with the dioritic formation of the region, but more schistons in some parts, which would incline to the conclusion that the limestone belt is comprised in the dioritic formation and is not a contact formation as might have been supposed at the outset.

A very remarkable fact is that, in certain parts of these borings which were closely followed by assays in the company's laboratory, zones were encountered that showed high percentages of gold, while in them was found a little copper sometimes native : comparative assays on the cores obtained seem to prove that gold exists in them in its native state. Figures have been given in the reports and prospectus published by the Company, some of which are very high, exceeding one thousand dollars, but these cannot be considered as average and prove rather that small zones rich in gold may have been struck.

All these facts are interesting and justify the works actually undertaken to ascertain the value of that region.

The company's intention appears to be to put in compressed air machines and pumps to sink shaft No 3 to a depth of about 300 feet, where it is hoped that a more highly mineralized belt of calcite will be struck.

A new company under the name of " *Duplex Gold and Copper Mining Co. of Matane* ", was organized during the year to prospect the lands adjacent to those of the Matane Gold-Copper Mining Co. Later these companies were amalgamated under the name of " *The Matane Mining and Smelting Co.*"

LEAD

The only galena mine of any value in the province, which is at Lake Temiscamingue, was not visited, but it is to our knowledge that it was not worked this year.

I have examined the indications of galena found on lot VII, 21, of Woodbridge (county of Kamouraska), 11 miles from St. Pascal (I. C. R). There is a small vein of sulphate of baryta, with a little calcite of 2 to 3 feet in thickness, which may be followed for the distance of an acre and in which an opening of some fifteen feet has been made. A little galena in fine grains is disseminated through the mass, but in too slight a proportion to be worked industrially, as it represents not more than 10 per cent of the mass. A picked specimen of this galena was assayed by Mr. M. L. Hersey with the following results : Galena= 45.3 %; Silver=traces.

Nothing was done this year either at the Marlow or the Calumet Island mines.

GOLD

In last year's report, I gave but few details upon the operations preceding the abandonment of lot 14 of the De Lery concession, in Beauce, by the Gilbert River Gold Fields, Company Ltd., as the company's representatives were absent from Canada. Since then I have obtained the following information.

A shaft going through the quicksand, had been begun towards the commencement of November, 1901, and fortunately completed in the beginning of January, 1902. The width of the bed of auriferous gravel was then ascertained by means of drifts run to the east and west and a main drift in a northerly direction was pushed forward approximately to the centre, for a distance of 490 feet, when the old Smart workings were struck and cross drifts, beginning at the extremity of the centre drift, were run for average distances of 50 feet representing the width of the streak of pay gravel. The hoisting was carried on by means of cars descending by gravitation to the shaft in which they were raised by a cage. Each car contained 7 barrow-loads and the maximum quantity raised in a day amounted to 150 car loads. All that part of pay gravel was worked in five months, yielding $5,100 worth of gold, and the works were abandoned in August, 1902.

In 1903, the same company undertook to sink a shaft in the S. W. part of lot 11 of St. Charles ; this work, begun in June, was pushed to a depth of 70 feet and a small gravel bed at the bottom was worked, which produced $400 worth of gold, some thirty men being employed during that period. A vein of decomposed quartz on the surface, having shown indications of gold, the company decided to make systematic borings in the quartz and, towards November, it purchased from the Keystone Drill Co., of Beaver Falls, Pa., U. S., a transportable machine, which was put into operation under the direction of an expert employee supplied by that company. This machine (No. 3 of the company's catalogue) conveyed in a wheeled vehicle, comprised a boiler and a drilling apparatus for a bore hole of 4 inches in diameter. The boring, called No. 1, is situated 20 feet to the north of the shaft, which had been allowed to fill with water towards the end of August, while retaining it, together with the drifts at the bottom, in good order to serve for subsequent working on the vein.

The work of boring was prosecuted as follows : 12 feet of surface, containing big hard boulders, were passed through on the first day, then next day, 50 feet of blue clay were pierced ; and, on the third day, the bed rock having been attained at 75 feet, the hole was tubed with a pipe of 6 inches and they went down 12 feet further into the rock formed of decomposed quartz. The work was continued in the same cavernous and decomposed quartz mixed with blue clay to a depth of 140 feet, the hole being tubed to 100 feet to avoid the water in the shaft. At 140 feet the solid quartz was struck ; down to that depth, colors of gold had been found, but which, strictly speaking, might be considered alluvial products ; they continued to be found, however, in the solid quartz. At 160 feet a very hard rock was met, which appeared to be quartzose diorite and which the drill had much difficulty to cut through to 164 feet, when it was decided to blast the rock at the bottom of the hole with dynamite. Owing to the want of suitable appliances, this was not a success and the season being advanced, the works were shut down for the winter.

I was present during the boring operations from 135 to 153 feet ; I washed the product obtained and I found colors coming certainly from the quartz, for small pieces had quartz still adhering to them. These colors, however, were very fine and in quantities too small to give a sufficent value to the quartz ; but this fact is important and noteworthy, for it is the first time that this style of operating has been practised in Beauce and that the quartz has been tested to such a depth. The quartz vein prospected has a thickness of 16 feet, runs N. E. and dips to the north at an angle of 65 degrees from the vertical, the boring being entirely in the vein. The company proposes to continue its borings at other points during the season of 1904.

OTHER PROSPECTS IN BEAUCE

Owing to the low water, some prospectors did a little washing on the lower part of the River du Loup and near the Little Falls of the Chaudiere ; among others, the Couture Brothers who found one nugget worth $18 ; these small workings yielded in all about $400 in gold.

DES MEULES BROOK

Some years ago, Mr. Compal, working on this brook, took out a quantity of gold valued at $10,000, and including four large nuggets

worth respectively $130, $170, $340, and $430. The works were stopped owing to troubles with the lessees of the land.

At the end of 1903, these difficulties having been settled, a company composed of residents of St. François and some other persons undertook prospecting work on the same brook, which was, however, stopped in November owing to the cold season. I visited those works and noted that prospecting had been done between the road and the Mill brook. The indications were pretty satisfactory and I understand that these works are to be resumed in the spring.

PROSPECTING IN DUDSWELL

The Dominion Mining Co. did some development work preparatory to subsequent workings on the Big Hollow brook, but without producing anything.

Mr. Louis Mathien also did a little prospecting on the same brook. A hundred dollars' worth of gold were taken out.

On the whole, the total output of gold in the province represents about $1,000.

ASBESTOS

The asbestos mines of Thetford, Black Lake and Danville were worked this year with the same activity as last year, operations being continued throughout most of the winter. At Thetford, the King, Bell and Johnson mines were in regular operation, while at Black Lake the Union mine was worked during the whole year and the Standard and Johnson mines during part of the year. At East Broughton, the working of the Broughton Asbestos mine was interrupted on the 23rd October by a fire which completely destroyed the 2 cyclone mill which had just been enlarged, and the machinery of that company. The construction of a new mill was at once begun to go into operation in the course of the year. At Danville, work was carried on regularly with the old mill and the new one was completed and put into operation.

In my report of last year, I mentioned a new company, the New England and Canadian Asbestos Company, which had in October, 1902, acquired the control of the Beaver mine at Thetford, of the Glasgow and Montreal at Black Lake, and of the Fraser mine at Broughton

The two former were slightly worked, with a small output, and in April, 1903, this company went into liquidation and the above mentioned properties reverted to their former owners. Work in the Beaver mine was resumed and this will possibly be also the case with the others. The New England Co. had taken out 400 to 500 tons of asbestos and had run the Beaver Asbestos Co.'s mill during a couple of months only and had not used that of the Glasgow Co.

At East Broughton, the Walsh & Mulvena mine, situated on lot VI. 13 b. of Broughton, was reopened and, at the end of the year, the construction of a mill was begun, which will be shortly started, the company being known under the name of *The Quebec Asbestos Co.* This mill comprises a building of 75 feet by 40, with 3 stories, and will contain 2 cyclones with the usual accessories, the whole run by a battery of boilers equal to 250 horse power. The mine will be worked by means of cable derricks.

At Black Lake, the old Murphy mine, on lot B 32, Colraine, which was worked on a small scale by Messrs Kerr & Co., was developed and the good indications found led to the formation of *The American Asbestos Co., Ltd.* This company has acquired from King Bros. Co. lot VII. 26. and the north-eastern part of lot VI. 26 of Ireland, which extends its territory to a little beyond the Thetford river, forming a total of 454 acres. During the winter, the erection was begun of a large mill, using the Sturtevant system of disintegrators instead of cyclones, and of an office, dwellings, and a tramway from the mine to the mill which is situated near the Q. C. R. line, where a siding has been put in. Electric power supplied by the St. Francis Hydraulic Company is to be used, supplemented by a steam plant for the generation of electricity in the event of accident or of insufficiency of power from that company. All these structures have been rapidly put up and are partly completed, so that it is probable that the company will be in operation shortly and prove a heavy producer in 1904. In the meantime, the development of the mine has been continued and the few feet of earth covering the serpentine in that region have been cleared away, a good quantity of asbestos and fibrous rocks being obtained for the mill, but no shipments were made during the year.

The Standard Asbestos Co., had very good results with the mill erected last year; old dumps of debris rich in fibre were treated and the old works situated in the northern part, near the Ireland line,

where a large quantity of asbestos was found, were developed. The mill consists of a 4 story building, 80 feet by 40, with annexes for the machines, the boilers and the dryer. The boilers are of 250 horse power and the mill contains 2 cyclones and room for another with the ordinary accessories for crushing the rocks and for defiberization. The mine is supplied with cable derricks and is equipped for a heavy output.

At Danville, the Asbestos and Asbestic Co., has completed the establishment of its new mill, which is now running and which is one of the largest in existence. I append a brief description of the plant which is composed of several separate buildings as follows :

Crushing works :

2	single	Blake	crushers of	36 inches by	24
2	duplex	"	"	40 "	10
2	"	"	"	40 "	6

connected by elevator chains of 40 feet.

Drying works :

4 cylindrical dryers of 46 inches diameter and 30 feet long, with 2 elevators of 40 feet.

These two works are run by a Corliss tandem engine of 250 horse power.

Grinding and defiberizing works :

4 cyclones with 7 suction fans of 45 inches diameter.

20 flat shaking screens and 6 revolving cylindrical screens.

The sand residue is conveyed outside by an endless belt of 475 feet. These works are run by a Corliss tandem engine, developing 600 horse power. The whole is lighted by 100 electric lights generated by a dynamo with a capacity of 200.

The mine is equipped with 8 steam hoisting drums of 20 horse power each, working 8 cable derricks and an air compressor of a capacity of 20 drills, Rand system.

Steam is supplied to the mill by a battery of seven boilers, besides a separate one at the mine, capable of furnishing 1300 horse-power. The fuel used is mostly fire-wood, from 150 to 200 cords of which are used per week.

Transport on the mine is effected by means of a small coal-burning locomotive and 54 cars of from 6 to 7 tons capacity. The derricks take out from the mine in 10 hours 500 tons of rock, 400 of which, containing fibre, go to the mill which extracts from them about 40 tons of fibre of every quality, thus giving a proportion of 8 % of useful material in the rock of this mine. Work is continued in the two principal excavations, the deepest of which is 170 feet below the top of the hill.

In addition to the new mill, there is the small 2 cyclone mill of whch we spoke in a previous report and which is intended for use in case of press of work or of repairs or accident to the large one.

The company owns the line and rolling stock of a railway 5 miles long, from the mine to Danville Station (Q. C. R), which it operates itself.

To sum up, we shall have in 1904 the following mines in operation and capable of producing a considerable outpnt.

At Thetford, the King, Bell, Johnson & Beaver Companies.

At Black Lake, the Union, Johnson, American, Standard, with a possibility that the Glasgow and Montreal, and the Manhattan mines will be re-opened and that the Reed mine will be developed on a larger scale.

At East Broughton ; Quebec Co., Broughton Co.

The probabilities are therefore that the outpnt for 1904 will be greater than that of 1903.

The output for 1903 may be pnt down as follows :

1st class crude.....	930	tons	worth.....	$ 117,847
2nd " "	2,354	"	"	227,919
Fibre.....	9,650	"	"	311,248
Paper Stock.....	16,327	"	"	259,956
Total.....	29,261	"	"	$ 916,970
Asbestic.....	9,956	"	"	13,292

Say a total of 39,167 tons of asbestos and asbestos products worth $930,262.00 and got out by the work of 7 companies. The principal mines were in operation throughout the year, employing about 1,300 men and paying $412,000.00 in wages. The probabilities are that the Thetford and Black Lake Companies will use electric power when it is established that they can get it in sufficient quantity and in a permanent manner.

MICA.

This year the amber mica industry assumed considerable development and seems destined to be established on permanent and solid bases. Prospects are being continued but when important mines are discovered they are developed on a larger scale. It is observed that there are fewer companies but a greater production. Thus, this year, we have only four important producers and they shipped or prepared mica to the amount of $75,000.00.

Blackburn Brothers worked throught the year with the same success as previously producing a large quantity of good mica which undergoes a first preparation at the mine and is afterwards shipped to Ottawa where the company has trimming works. A certain quantity of phosphate is also obtained with the mica and over 300 tons were shipped. The workings have reached a depth of 180 feet and the mica indications continue to be good.

Wallingford Mica and Mining Company.—This company was organized last year with the property of Wallingford Brothers and others, comprising lots VIII, 16 and 17 of Templeton (Wallingford Mine), to which were added lots XIII 4 and 5 (Battle Lake Mine) of the same township. The three main shafts of the Wallingford mine which are 130 to 160 feet deep, have been emptied of water and new steam machinery and derricks put up. The mica is conveyed to Ottawa to be trimmed in the company's works. Fresh discoveries have been made at the Battle Lake mine, formerly opened for phosphate, steam machinery has been put up and houses built for the workmen. I visited those two mines last year ; they were in full operation, about 80 persons being employed and there was a large quantity of good mica, besides about a hundred tons of phosphate that had been got out at the same time.

This company's works are in Ottawa where the mica is trimmed for shipment.

Fortin & Gravelle did but little work in their mine this year; they made fresh discoveries with a few men and found a quantity of good mica. Their works are in Hull whence they shipped a portion of the mica trimmed last year.

The General Electric Company worked during part of the year the Chaibee mine, situate on lot A 7 of Wright, whence a good quantity was got out and sent to the company's works in Ottawa. This mine was worked by means of underground workings, a shaft of 90 feet and some adits having been excavated. Steam machinery had been put up, which was removed when I visited the place at the end of October. The ground had also been explored by means of a diamond drill.

Wakefield Mica Company, Limited. This company, which was organized to work the Kodak mine on lot II. 16 of Wakefield, did some work during the summer. The main shaft was emptied and an electric plant was installed, using the power supplied by falls on a small stream in the vicinity supplemented by a steam engine. At the time of my visit, some men were working and good indications of mica were observed, a certain quantity having been sent to Ottawa. At this mine experiments were made with the Jackson hand drill which seemed to give good results in the absence of steam or compressed air. I have since learned that the company has gone into liquidation.

Brown Brothers, did but little work this year on lot VII. 19 of Hull (Aberdeen mine), consisting chiefly in opening up several new outcroppings which show very remarkable indications of mica, some tons of which were got out. They also did a little mica trimming in their works at Cantley, but shipped none.

Varassour mine.—A little work was done in the way of developing; a few tons were got out but nothing was shipped.

The following mines were prospected and produced small quantities of mica.

Fleury Bros. (Hull, VII, 20).

J. J. Noble, (Buckingham, XI, 28).

Kent Bros, (Hull, VI, 14).

E. Watts, (Portland West, X, 7).

Joshua Ellard, (Alleyn II, 10).

A new company *The Laurentian Mica Company, Limited* was organized at Ottawa where it has established important works, employing 125 persons ; but hitherto it has done no mining in the province, contenting itself with purchasing crude mica.

W. Webster & Company did a little prospecting in the neighborhood of Perkin's Mills and at the Cascades of the Gatineau but without getting any merchantable mica, they have however continued work at their trimming establishment in Ottawa.

The following companies did not work during the year, viz : Glen Almond Mica & Mining Company, Richard Moore, Lila Mining Co., Ls. McLaurin, Allan & Co.

The conditions of the market had become uncertain after the manufacture of micanite which had caused a fall in prices of the larger sizes. Things seem to have taken a more regular turn and, as compensation, there is a market for the 1 x 2, since thin-split mica has been prepared in Canada. This new product is obtained in the trimming works, by carrying the cleavage as far as possible. To do this the irregular parts are first knife-trimmed and young girls split them with a knife after sand-papering the cut to open the sheets. The mica is classified before and after the cleavage and it is shipped in boxes, for the purpose of making micanite, to the United States where it is subject only to an *ad valorem* duty of 20 % and a specific duty of 6 cents per pound like uncut mica. This operation is performed in Ottawa on a large scale by several companies, amongst others The General Electric Company, the Laurentian Mica Company and others, giving regular employment to from 500 to 600 persons, partly young girls

The price of thumb-trimmed mica per pound, in barrels and boxes at Ottawa, may be quoted as follows :

1 x 2	5 cts.
1 x 3	12 cts.
2 x 3	25 to 30 cts.
2 x 4	35 to 40 cts.
3 x 5	55 to 60 cts.
4 x 6	75 cts.
5 x 8	$1.25.

I would recall the fact that rough culled mica gives a proportion, of 75 % of thumb-trimmed mica, containing 1 x 2, and 50 % without that quality. It may thus be estimated that, on the average, under ordinary conditions, the ton of rough-culled mica is worth about forty dollars at the mine.

The quantity of mica shipped from the mines either abroad or to the companies to Ottawa was as follows for 1903.

1 x 2	20,382	lbs	worth	$ 1,019
1 x 3	131,085	"	"	17.120
2 x 3	67,245	"	"	18,632
2 x 4	46,304	"	"	19,639
3 x 5	18,942	"	"	11,649
4 x 6	4,646	"	"	3,535
5 x 8	2,029	"	"	2,525
	290,624	"	"	$74,119

Say a total of 145 tons of thumb-trimmed mica to which must be added a certain quantity of mica not yet trimmed or sold.

This industry gave employment to about 150 men engaged in the mines and 80 in trimming. The total wages paid represent $45,000.00 and work was carried on for periods varying from 2½ to 12 months.

I also call attention to the fact that amber mica has been shipped to Europe and we have received several applications for information with regard to the possibility of sending Canadian mica there regularly.

None of our mines of white mica (muscovite) have been worked for several years. Nevertheless, since the discovery of radio-active minerals in those mines, they are attracting more attention and it is probable that work will be done in some of them this year. It has further been found that the admixture of a certain proportion of white mica was of advantage in the manufacture of micanite and that it is in demand for such purposes, which may promote the development of those mines.

To the list of white mica mines may be added one situate at the head of the third falls on the Mistassibi river about 40 miles above Mistassini village. I visited that mine last season and found a well developed vein of pegmatite showing, on the surface, mica crystals of good size but slightly spotted. The remoteness of the mine is moreover too great to prevent its being worked at present.

I also examined the indications of white mica near the ninth lake of river aux Canards (Charlevoix county), which lie in a great mass of pegmatite, which I referred to in previous reports. Well managed prospects might perhaps show the existence of mica in workable quantities in that region.

PHOSPHATE

As in previous years phosphate was not mined directly but what was shipped came from the mica mines, from some of which a good quantity was got out.

Mr. J. F. Higginson, the manager of the *Capelton Chemical and Fertilizer Company*, reports that he shipped from the Ottawa region in 1903 :

1034	tons of 1st class phosphate, worth.....		$7,755 00
153	" 2nd " " "		459 00
Total...1187	tons, worth.....		$8,214 06

With the exception of some 30 tons shipped to Ontario, the whole was used by the Electric Reduction Company of Buckingham for the manufacture of phosphorus. That company also imports phosphate from the United States, but I am informed that it is disposed to use Canadian phosphate, provided it does not cost more. No phosphate was shipped to the Capelton fertilizer factory this year, because the

Capelton Chemical and Fertilizer Company has been organized independently with its place of business in Buckingham, where it is proposed to establish the factory, and at Capelton the products in store were merely disposed of. The question of restoring the phosphate industry in the Ottawa region is of the greatest importance and would assuredly be solved if a local market could be secured for low grade phosphates that cannot be exported. The use of superphosphates in farming has given sufficient proofs of its efficiency to make it unnecessary to refer to it here, but it would be important to accustom our farmers to make use of it and the interested parties have asked the Provincial Government to help them by supplying the agricultural societies with a certain quantity of that product which would then be distributed to the farmers who, when once they would be familiar with its good effects, would buy it in preference to American fertilizers. It is to be hoped that the Government will take this question into serious consideration. On the other hand, the Federal Government might assist with a bonus.

By these means, an industry of great importance to the province would be revived.

I would add that the consumption of phosphates throughout the world has not decreased and that our 80% apatite would find an easey market which has been stopped solely by the extensive production of certains regions, amongst others South Carolina, Tennessee and Florida, which has lowered prices. As our deposits are very extensive, if the aforesaid advantages were granted by the Governments, there would be a likelihood of seeing the revival of an industry which would then become permanent owing to the development now being assumed by agriculture in Canada.

GRAPHITE

Nothing of any importance has been done in connection with this industry last year since the former North American Graphite Company ceased working. Nevertheless, a new company has been formed which, with the aid of new concentration processes, will probably put this industry on a business footing. That company was recently organized in Birmingham, England, under the name of *The Anglo-Canadian Graphite Syndicate, Limited*. Its object is to use the plant and ores

of the old North American Company, in addition to rights and options on 3,000 acres of land in the county of Ottawa, and to build this year three concentration mills at various points of the territory and a finishing mill at Buckingham, using the patents of Mr Brunnell, who has made a speciality of this industry. Preparatory work will be done on the old mill to ascertain the value of the new processes after which the building of the new ones will be begun.

The quality of our graphite is well established and it is sure of an important market when the latter can be supplied with regular quantities. It is therefore to be hoped that this new company will be the starting point of a permanent industry which cannot but develop if we consider the growing need of that product by the electro-metallurgical industry.

The Buckingham Company worked for a couple of months last summer with about fifteen men, prospecting its territory and sinking a new shaft on lot VI, 26 of Buckingham. Some alterations were also made to the mill where about 75 tons of crude ore were treated experimentally. That company will probably resume work next summer.

In the Calumet region nothing was done beyond some prospecting with about ten men by the Calumet Mining and Milling Company which shipped some tons to New-Jersey as an experiment. The Keystone Graphite Company has taken the name of The Grenville Graphite Company.

SULPHATE OF BARYTA

The Canada Paint Company continued, during the six summer months, to work the Hull mine whence 440 tons, worth $2,640.00, were shipped from Iron Side station. This product is used for the manufacture of paint in the company's works, in Montreal.

When I visited the mine in the month of September, the workings consisted of an opening 40 feet deep and 100 feet long in a N. S. direction on the vein descending vertically, with a thickness of from 2 to 4 feet. The vein consists of white and violet calcite, of greenish fluor-spar and white sulphate of baryta and runs through the gneiss of the region in a direction normal to the stratification It may thus be looked upon as a regular vein with a likelihood of being continuous.

The mine is worked by a small steam engine of 20 horse-power and, moreover, a dozen men are employed who pick the ore by hand.

FELDSPAR

No work was done in connection with feldspar, this year and only about fifteen tons, valued at $37.00 were shipped from the township of Templeton. Nevertheless, we must not lose sight of the fact that there is a market for that product, as is proved by the shipments to Ontario, and that the demand may increase for other uses than ceramics

MINERALS CONTAINING RADIUM

It is needless to refer to all that is said about this new element which is attracting the attention of scientists throughout the world. But, knowing that it is usually found amongst the ores of uranium, it occurred to me to try a mineral found a few years ago in the white mica mine situate at lake Pied des Monts, 18 miles behind Murray Bay (Charlevoix Co). From its external properties I had identified it as cleveite, a variety of uraninite. The first trials consisted of a print produced on photographic plates and it was afterwards ascertained that the rays emanating from that specimen traversed opaque bodies such as thin boards of an eighth of an inch in thickness, sheets of tin and black paper, producing a photograph or rather a radiograph of less permeable objects such as coins, keys, etc. I afterwards found that this mineral perceptibly discharged the electroscope and, on comparing it with the salts of uranium which possess the radio-active property to a much less degree, I came to the conclusion that these remarkable properties could be due to nothing else but radium. To obtain the confirmation of this I submitted the specimen in my possession to Professor E. W. Rutherford, of McGill University, a member of the Royal Society, who has made a reputation through the discoveries of new properties of radium. Mr. Rutherford was kind enough to make assays in his laboratory and he ascertained the radio activity of the mineral which he recognized as being due to radium

The well crystallized specimen in my possession has a density of 8.43 measured by Professor Harrington, of McGill University, and weighs 375 grammes or about 13 ounces.

Mr. Rutherford found that this piece contained one tenth of a milligramme of radium ; that its radio-activity was 4 to 5, that is 4 to 5 times greater than if the whole piece were of oxyde of Uranium ; that this excess was due to radium, and, to sum up, that this ore could compare with the best pitchblendes from which radium has hitherto been extracted.

A small specimen was also sent to Mr. and Mrs. Currie who, in reply, mentioned that its radio-activity was equal to six times that of uranium. In consequence of its great density, this mineral might resemble another variety of uraninite, but, for the present, I think we may retain the name of *Cleveite*. It crystallizes in dodecaedron, its color is brown with a yellowish coating. It is partly soluble in cold nitric acid and completely, with a small residuum not yet studied, in the same acid boiling. An essay made by Mr. M. L. Hersey, of Montreal, showed that it contains 70.71% of uranium, corresponding to 85% of sesquioxide of uranium.

This specimen is a very remarkable one, and is not unique in that mine, for I found several small pieces in the debris.

I must also mention an interesting mineral found in the same mine It is a coaly substance that burns pretty easily leaving a considerable proportion of ash containing a marked quantity of oxyde of uranium, i do not know the geological relation between these two ores but it is worth studying. It has been examined by Mr. Hersey, who gives the following opinion regarding it :

" This is a sample of coal of a somewhat fibrous irregular structure and containing a small amount of mica. It is really a non-coking bituminous coal yielding considerable gas which burned with a bright yellow flame.

The following are the results of analysis obtained from this sample :

Volatile matter (including volatile combustible gas and small quantity of moisture).....	40.185
Fixed carbon.....	52. 59
Ash.....	7.225
Total.....	100. 00

The ash was essayed and contained 35.43% of uranium corresponding to 2.56% of that metal in the coal ; it was of an olive green color which was found to be due to the oxyde of uranium. Another assay was made directly on the coal which after being pulverized very fine was treated with boiling nitric acid and afterwards subjected to the usual analytical process. The percentage of uranium was found to be perceptibly the same. This process is certainly not the most practical one but it is interesting to note that uranium can be obtained from it by treating the coal directly with nitric acid.

This coal has been found to be radio-active as are also the ashes obtained by its calcination and which contain radium. The precipitate of uranium also contains some, this fact being established by the assay of its radio-activity.

In my report on mica in 1901, I mentioned the rare minerals found in the mines of muscovite, such as uraninite and monazite, in the Villeneuve mine (Ottawa Co.): samarskite in the Maisonneuv mine (Berthier Co): and finally, cleveite in the Pied des Monts mine (Charlevoix Co.) But there are other mines of white mica in the counties of Ottawa and Pontiac, in the Saguenay region, at Bergeronnes, on the North shore and to the north of Lake St. John where similar minerals may be found and it would be wise for miners and prospectors to make an intelligent examination of all rocks presenting special characteristics.

I give below some notes on radium to justify the importance attached to the discovery of that new element.

Radium was discovered in 1898 by Mr. and Mrs. Currie, two French scientists, in residues of ores of uranium. Its properties have since been studied by scientists of all nations, amongst whom we may mention, in Canada, Professor Rutherford of McGill University, Montreal, and Professor McLennan, of Toronto University. Many studies of this body have been made and would furnish sufficient matter for several volumes. I will sum them up as follows : Radium has not been isolated in the pure state and is known only in the shape of salts, amongst others ; of bromide, chloride and carbonate, mixed with other bodies to which it communicates its properties, the chief of which is known

as radio-activity manifested by emanations and the production of light, electricity and caloric. In a word that body, without being submitted to any external action, constantly produces light, electricity and heat ; moreover, it produces the phosphorescence and fluorescence of bodies such as sulphide of zinc, sulphide of calcium, villemite or silicate of zinc, kunzite (crytallized spodumene), etc. It produces rays similar to the Roentgen rays, acts on photographic plates, through opaque bodies, and discharges the electroscope. The quantity of salts of radium obtained so far, represents only a few grammes and the ores containing it are eagerly sought after. Bohemia (Austria) is the region that produces the most, but the Austrian Government has forbidden the exportation of the pitchblende containing it. In Norway there are small quantities in formations similar that of our Laurentian range and the Government gives bonuses for specimens found in it. To give an idea of the relative value of this metal, the first gramme of almost pure salt cost $30,000.00. It is very difficult to find any in the trade although some manufactories of chemical products offer it at approachable prices. Thus, I have seen a circular from a German house, advertizing at the price of $300.00 per gramme (the 31st part of an ounce), a mixture containing 10 % of bromide of radium. The price increases considerably in proportion to the purity of the mixture. Another house offers bromide of radium, of an activity of 300,000 at the price of $120.00 per centigramme.

This shows the importance of ascertaining the existence of ores of uranium in this province and the Quebec Bureau of Mines, as well as its annex, the Assay Office in Montreal, are prepared to make assays and ascertain whether they contain radium.

The probabilities are that there may be ores of uranium in the white mica mines : they are recognizable by their weight, their brown or black color and, if they contain radium, by their action on photographic plates and the electroscope.

In the work I have done in connection with the study of minerals containing radium, I have received intelligent and practical assistance from Mr. G. Rinfret, of this department, who undertook the photographic portion of the experiments.

MANGANESE AND GYPSUM

Under this head I include chiefly the ores of the Magdalen I. lands, which I visited last summer, and I describe the rather rapid exploration I made there.

The only work on that region is that of Mr. James Richardson, published in the report of the Geological Survey of 1880, and which gives geological sections of the formations in sight on some parts of those Islands.

The Magdalen group comprises thirteen islands of various sizes, and the most important section, with the exception of Bryson and Allright islands, can be traveled over on foot or in vehicles for a distance of 60 miles in a north-easterly direction and over a width of 12 miles, the islands being connected by sand-banks or dunes.

They must have formed part of the continent, at some period of their geological history, and have been connected with Prince Edward Island situate 50 miles to the southward, the sedimentary part of their structure consisting also of grey and red sandstone. While the strata in Prince Edward Island have, as a rule, remained stationary the formation in the Magdalen Islands has been displaced by an upheaval of eruptive rocks which has completely tranformed its relief. This upheaval has been general throughout the archipelago and in some places has raised hills from 500 to 600 feet high, constituting the nucleus of the islands while, amongst them, the eruptive rock has not shown up on the surface. Although this fact has not been materially verified, I see no other reason for the existence of sand banks from 10 to 12 miles long between the principal islands than the presence, probably at a slight depth, of a ridge of eruptive rocks which maintains these banks in spite of tides and currents. The geological formation of these islands thus presents great uniformity, and what may be said of one can apply to the others; it consists of beds of grey or reddish sandstone, generally broken up and resting on the eruptive rock which has been called diabase and dolerite, but which presents a variety of basic rocks probably of rather recent origin; the aspect of these rocks is moreover variable according to their more or less advanced state of decomposition. It is quite possible also that there have been several periods of eruption or rather that an

ancient eruption has been brought to light by a more recent one which would explain the fact that compact diorite is found in the vicinity of the diabase or even the trap which, on contact with the atmospheric elements, disaggregates and decomposes, forming banks of clay of various colors. The interesting portion of these islands it therefore the eruptive part and it is important to study its action on the bringing into sight of the economic minerals found in it and especially manganese and gypsum. The sedimentary formation of these islands, as well as that of Prince Edward Island, had been classified by the Geological Survey, in the lower carboniferous characterized by limestones containing fossils, only some of which have been studied, and surmounted by the sandstone above mentioned. This limestone has been found on a few points only of the islands, especially in the eastern part of Coffin Island. The eruptions of basic rocks have been accompanied or followed by chemical action in which the metallic sulphides have been oxydized, producing the sulphating of the calcareous rocks, the greater part of which has been transformed into sulphate, while the oxydes of manganese and iron remained, constituting the deposits that now occupy our attention. The opinion is also expressed that manganese originally existed in the state of carbonate and was subsequently transformed into oxyde. I am therefore inclined to believe that the deposits of gypsum have a very direct connection with the deposits of iron and manganese.

These masses of gypsum are very considerable, quite accessible and could easily be worked. I would observe that, in these islands, manganese is found in the form of pyrolusite or peroxyde of manganese slightly hydrated, of manganite or peroxyde more hydrated and of bog manganese which alone have an industrial value. It is nevertheless probable that there is also some psilomelane or barytic manganese for I ascertained the existence of baryta, and I presume it is the carbonate of manganese that gives the pink color observed in several rocks and clays of that region.

The most important point where manganese ore has been found is in the middle of Grindstone Island on Quinn's lot. Several years ago a slight excavation was made whence several tons of pyrolusite of good quality were extracted and shipped. This work had been done on surface indications where rocks free from manganese are still to be seen which, lower down, are imbedded in a kind of calcareous conglomerate also containing eruptive rock. This rock seems to be in contact with diabase and red sandstone, and I think that a shaft sunk

through this sandstone a short distance to the west would show the underground prolongation of the out-cropping above mentioned.

On the east side of the island and north of Cape Grindstone wharf is a strip of pink clay due to the decomposition of dolerite on which it rests and which runs in a north-westerly direction ; it may well be the continuation of the aforesaid out-cropping.

In the north-west part of Grindstone Island, about a mile and a half above the lighthouse, is a large deposit of gypsum and a little higher, on the land of Arsène LeBlanc, a small excavation shows many small pieces of pyrolusite with dolerite.

I made a complete tour of all the islands and I also found manganese and limonite in the southern part of Grosse Ile, as well as gypsum and limestone on Coffin Island.

I also found in the middle of Allright Island, important indications of limonite mixed with manganese as well as deposits of gypsum.

I followed the shores of Amherst Island and observed the following :

On the land of Hyppolite Hébert, lot 40, near the West point, is an out-cropping of dolerite near which were found on the surface several pieces of manganite, some of which weighed 15 to 20 lbs.

From that point to the village of Portage Road there are great masses of gypsum with funnel-shaped holes characteristic of the deposits of gypsum of that region.

Before reaching that village there are several deposits of bog manganese.

A short distance before coming to Amherst village is a large hill 500 feet high consisting of dolerite which, on the north side near Plaisance Bay, is broken by the sea and presents an interesting section showing the solid and decomposed eruptive rocks as well as the gypsum beds.

Towards the north-west, in the fields, pieces of manganite and pyrolusite are found. The same indications are observed on the

south-west side of the hill where are numerous beds of bog manganese ore mixed with iron ore highly charged with manganese.

The bluff near Plaisance Bay is called " Côte de la demoiselle " and Mr. O. J. Richardson's report states that there are blocks of pyrolusite there weighing from 10 to 15 lbs which, in his opinion, come from a deposit on the hill-side masked by land slides.

I was unable to visit Entry Island, but I was assured that pyrolusite and limonite are found there as on the other islands.

All these islands are partly denuded and there is nothing on them but a few stunted spruce trees, and fuel has to be brought from Nova Scotia. The Federal Government has recently had wharves built and access is easy in the summer time but communication with the mainland is interrupted in winter.

The population is about 6,000 and the chief industry is fishing but the soil is good and can suffice for the needs of the inhabitants. The various islands are crossed and connected by good roads.

To resume and without entering into details which would be too lengthy for this work, the following industrial minerals are found on the Magdalen Islands :

1. Pyrolusite and manganite, the existence whereof is fully established at various points and their indications would justify prospects being undertaken with a probability of finding important deposits ;

2. Bog manganese in great abundance, probably due to the decomposition of the aforesaid minerals and which confirms the idea of considerable deposits of manganese ore ;

3. Limonite generally in nodules, frequently mixed with manganese which might be worked in connection with the foregoing. Hematite is also found ;

4. Gypsum in very great quantities on all the islands ;

5. Clays of various colors, white, green, red, pink and black ;

6. Sandstone for building ;

7. Quartzose sand on the beaches due to the decomposition of the sandstone. This sand has been assayed ; it contains 97 % of silica and seems well adapted to the manufacture of glass.

These islands which constitute a kind of seignory, have not been prospected by the surface occupants, but I think that well directed prospects would establish the value of the manganese deposits they contain. They have since become the property of the *Magdalen Islands Company*, and it is to be hoped that work will be done by the new owners.

PEAT

The National Light Heat and Power Company has set up an experimental plant at St. Bridget, near Farnham, and good results seem to have been obtained. A small quantity of compressed peat was prepared, supplying good fuel for industrial purposes and for domestic use. The company proposes to extend its work and establish regular manufacturing centres.

I recently visited the plant and give the following information in connection with it :

The works are situate between the line of the Vermont Central and that of the Canadian Pacific, in the neighborhood of the village of St. Bridget, some 12 miles from St. Johns and 3 miles from Farnham. The property includes a peat bog of 1,000 a .es, where the peat is of varying thickness, sometimes extending to 32 feet, but which is considered to be 15 feet on an average.

The operations consist in conveying the wet peat in a distributor which, by a means of an endless chain, brings it into boxes with a screen on the bottom and resting on a grating of iron bars. These boxes pass under a press which removes a portion of the water, the product then falls into an elevator which carries it to a first drier, in front of which is an appliance for removing the roots and large pieces. This drier is made up of four sections or square boxes of a total length of 55 feet. They are heated : firstly, by steam from the engine ; secondly, by a direct current of hot air conveyed by a fan, and thirdly, by the heat produced by the combustion in the furnace of the second drier.

The peat is pushed into those four sections by screw paddles revolving between the series of hot pipes, between which the peat is pressed.

From the first drier the peat passes to a second consisting of a coil pipe six inches in diameter passing through a furnace heated directly. The peat pulp partly dried, is forced along by a current of air which brings it to the compressing apparatus after it has passed through the coil.

The compressor consists of a pipe into which a piston, driven by a lever excentric, pressess the peat by lateral pressure alone in a continuous cylinder 2½ inches in diameter. This pipe is surrounded by a double casing in which a current of superheated steam circulates. It is claimed that 30 bricks from 2 to 3 inches long can be made per minute.

The total capacity of the works would be 50 tons per 24 hours, requiring 8 men per 12 hours and employing 80 horse-power; the capacity of the present driers would have to be trebled.

At present the works are experimental and the peat is conveyed in wheel-barrows but the company intends to put all the machinery on a pontoon with a dredge which will convey the peat directly to the machines.

I submitted some samples I had taken to Mr M. L. Hersey, who reported on them as follows :

Natural peat, wet	89.00% of water
" compressed	70.00
After first drying	58.19
" second "	20.53

Analysis of compressed peat :

Moisture	15.37%
Volatile combustible matter	60.57%
Ash	3.86%
Fixed carbon	20.20%
	100.00
Say : Volatile matter	75.94%
Coke	24.06%
Sulphur	0.25%
Density	1.41

The density of bituminous coal is 1.2 to 1.4 and that of anthracite is 1.57 to 1.67.

The calorific value of this compressed peat is 5,480 calories equal to 8,767 British thermal units.

This peat burns very well without disintegrating which is an important fact as most peat products disintegrate in the fire.

The sample soaked in water for 5½ days increased 23.6 % in weight without disintegrating.

The quantity of water is still rather great, which diminishes the calorific value. Nevertheless, many samples of lignite coal from the west contain as high as 20 % of water and practically this compressed peat corresponds to air dried maple which equals 5,187 calories.

Considerable progress has thus been made in this industry, and it is characterized by the following facts :

The peat pulp passing through the last drier heated almost red hot, reaches a state bordering on carbonization when the bituminous hydrocarburetted matters are set free and, at the moment of compression, act as binding matter which also prevents the re-absorption of the hygrometric moisture.

It is to be desired that this industry will be developed in this country, where I consider there is a future for it.

The company has been reorganized under the name of *The Imperial Light, Heat and Power Company, Ltd.*, of Montreal, and it proposes, if its experiments succeed, to push on its work without delay.

MISCELLANEOUS.

There is nothing to mention in connection with petroleum in Gaspé ; no borings were done during the year, but the Petroleum Oil Trust is still in existence, and as its directors are interested in the building of railways in Gaspesia, it is likely that work will again be undertaken when communication with the interior has been made easier.

Natural gas has again been found at several points in the province, and it is used for industries on a small scale and for domestic purposes. No systematic searches have yet been made, but we may

expect that the attention of capitalists will be attracted to this fuel which, if found in commercial quantities as it probably will be, would have a great influence on the industrial development of our province.

No work has been done on the indications of molybdenite, but applications are frequently made to us in connection with this mineral which would find a steady market.

CEMENT

Mr Thomas M. Morgan's factory, at Longue Pointe, has increased its output and added a new mill worked by electric power.

The International Portland Cement Company Ltd has worked very actively to establish its factory at Hull, and will be in a position to turn out cement in the month of June of this year. Its output will be from 1,500 to 1,800 barrels a day. This company has purchased 330 acres of land on which are considerable outcroppings of Trenton limestone and deposits of clay which have been found to be of great thickness. Borings have been made in the limestone and have shown the uniformity of its composition. The following analyses have been communicated by the company.

ANALYSIS OF LIMESTONE

Silica	3.34
Alumina and oxyde of iron	2.05
Carbonate of lime	90.15
Magnesia	1.42
Sulphuric acid	1.13
Loss	1.90
	100.00

ANALYSIS OF CLAY

Silica	56.10
Alumina	22.70
Oxyde of iron	11.36
Lime	2 30
Magnesia	2.99
Sulphuric acid	0 60
Organic matter	3.95
	100.00

These analyses are looked upon as proving the good quality of the materials to be employed.

The factory is situated in the immediate vicinity of the outlet of the Gatineau river into the Ottawa, of the Gatineau railway and of the Canadian Pacific. The latter company has made special sidings for the factory.

The company has also purchased the Cascades falls on the Gatineau which are said to be capable of furnishing 14,000 horse-power, but it does not intend to use them at once and has made arrangements with the Hull and Ottawa electric company for the 2,000 horse-power it needs at present.

This company is therefore excellently situated for producing cement economically and, as the works already erected in the United States and Canada by the same people have established the value of the system followed and of the product obtained, it is to be hoped that, with a customs duty of 40 cents per barrel of 350 lbs, and with a constantly increasing market for cement as shown by statistics, this industry will have a bright future.

In a subsequent report I will give full information regarding this manufactory and its processes, but I may say that the process consists in burning, in long revolving cylinders, limestone and clay previously dried and pulverized, heat being produced by the injection of finely crushed coal with air into the cylinders. The work will be in a great measure automatic and will consist in extracting, breaking and crushing the limestone and clay ; in mixing them in certain proportions, breaking and crushing the cement and then barreling it. The importance of these works can thus be seen : they will employ from 100 to 150 men day and night and consume 75 tons of coal per diem, besides the electric power. The main building is 1100 feet by 700 and is built partly of cement stone.

BUILDING MATERIALS.

This industry continues to progress and it would be desirable that we should devote more attention to our splendid granites, marbles, labradorites, serpentines, etc., which can supply such fine stone for both interior and exterior ornamentation. Granite has continued to be quarried at Rivière à Pierre, Stanstead, Argenteuil, Mount Johnson, St. Samuel. Slate has been got out at New Rockland, flag stones at Dudswell, limestone for building in the neighborhood of Quebec, Montreal and Hull, as well as at several other points on the line of the Canadian Pacific Railway between those cities.

Bricks continue to be manufactured in large quantities and new kilns are erected every year. The same remarks apply to lime and, in both cases, it is impossible to mention them all owing to the great many small manufacturers.

STATISTICS.

In the following tables will be seen the total products of the mines shipped or used on the spot, from the operators' reports with their gross value at the nearest shipping point.

SUMMARY STATEMENT OF THE YIELD OF THE MINES IN THE PROVINCE OF QUEBEC, FOR THE YEAR 1903.

KIND OF MINERALS. (Tons of 2,000 lbs.)	Wages paid.	Number of workmen.	Quantities shipped or used.	Gross value.
Titanic iron ore	$ 150	.....	112	$ 300
Bog iron ore	20,000	60	12,035	34,985
Chromic iron	35,000	150	3,020	45,300
Copper ore	83,000	280	26,481	109,875
Asbestos	415,000	1,300	29,261	916,970
Asbestic	.....	.....	9,906	13,292
Mica (thumb trimmed)	45,000	230	145	74,119
Ochre calcined	9,100	50	1,746	20,440
Feldspar	.....	.....	20	37
Sulphate of Baryta	2,000	10	440	2,640
Phosphate	.....	10	1,187	8,214
Gold (ounces)	2,000	15	55	1,000
Slates (squares)	1,560	40	5,510	22,040
Flag stones (square yards)	1,575	7	3,000	2,550
Cement (barrels)	30,500	70	40,000	66,000
Granite	50,000	200	.....	160,000
Lime (bushels)	.....	350	1 million	140,000
Bricks	600,000	1,200	120 "	625,000
Stones	.....	700	.....	530,000
Totals	1,308,925	4,662	.....	$2,772,762

Thus, in 1903, our mines produced a value of nearly three million dollars of minerals in the raw state or having undergone a first preparation to make them merchantable.

Four thousand six hundred men were employed to whom thirteen hundred thousand dollars were paid in wages. As regards accidents, only one death and two cases of serious injury have been reported.

9,535 $\frac{1436}{2000}$ tons of charcoal pig-iron worth $239,636.46 were produced.

We are not yet in a position to give the value of the various products manufactured with other minerals of the province, but we give below a partial list of some kindred industries.

LIST OF MINING COMPANIES IN THE PROVINCE OF QUEBEC IN OPERATION OR IN A POSITION TO WORK DURING THE YEAR, WITH THEIR ADDRESSES

IRON

Chs. Lionais, Kinnear's Mill, Megantic Co.
H. C. Bossé, 20, St. James Street, Quebec.
W. Robertson, 233, St. James Street, Montreal.

CHARCOAL PIG IRON

The Canada Iron Furnace Co., Canada Life Building, Montreal.
John McDougall & Co., 597, William Street, Montreal.

OCHRE

The Canada Paint Co., 572, William Street, Montreal.
The Champlain Oxyde Co. (Lucien Carignan), Three-Rivers.

CHROMIC IRON

Black Lake Chrome & Asbestos Co., Black Lake, Megantic Co.
American Chrome Co., Black Lake.

Montreal Chrome Iron Co., Ltd., Colraine, Megantic Co.
Star Chrome Co., Colraine
Thetford Chrome Co., Thetford Mines, Megantic Co.
King Bros Co., Thetford Mines.
R. T. Hopper, Merchants Bank Building, Montreal.
L. A. Carrier & Co., Lévis.

COPPER

Eustis Mining Co., Enstis, Sherbrooke Co.
The Nichol's Chemical Co., Ltd., Capelton, Sherbrooke Co.
J. McCaw, Sherbrooke.
James Reed, Reedsdale, Megantic Co.
A. O. Norton, 280, Congress Str., Boston, Mass.
The Matane Mining & Smelting Co., Ltd., Matane.

LEAD

The British Canadian Lead Co., Ltd., Lake Temiscamingue, Pontiac Co.

GOLD

The Gilbert River Gold Fields Co, Ltd., Saint François, Beance Co.
Dominion Mining Co., C. A. Parsons, 154, Commercial Str., Boston, Mass.
Louis Mathien & Co., East Angus, Compton Co.

GRAPHITE

The Walker Mining Co., Graphite City, Buckingham, Ottawa Co.
The Anglo Canadian Graphite Syndicate, Ltd., Buckingham.
The Buckingham Co., Buckingham.
Grenville Graphite Co., Calumet, Argenteuil Co.
Calumet Graphite Co., Calumet.

MANGANESE

The Magdalen Islands Co., 81, St. Peter Str., Quebec.

ASBESTOS

Bell Asbestos Co., Ltd., Thetford Mines, Megantic Co.
King Bros. Co., Ltd., Thetford Mines.
Johnson Co., Thetford Mines.
The Beaver Asbestos Co., Thetford Mines.

American Asbestos Co., Ltd., Black Lake, Megantic Co.
The Standard Asbestos Co., Ltd., Black Lake.
The Glasgow & Montreal Asbestos Co., Black Lake.
Manhattan Asbestos Co., Black Lake.
Union Asbestos Mine, Black Lake.
James Reed, Reedsdale, Megantic Co.
The Broughton Asbestos Co., Ltd., East Broughton, Beauce Co.
The Quebec Asbestos Co., East Broughton.
The Asbestos & Asbestic Co, Ltd., Danville, Richmond Co.
The Ottawa Asbestos Mining Co., 514, Sussex Str., Ottawa.

MICA

The Wallingford Mica & Mining Co., 41, Duke Str., Ottawa.
Blackburn Bros., 46, Sussex Str., Ottawa.
General Electric Co., Isabella Str., Ottawa.
Fortin & Gravelle, Hull, Co. Ottawa.
Mica Manufacturing Co., Ltd., 213, Dailhousie Str., Ottawa.
Vavassour Mining Association(T.F. Nellis),22,Metcalfe Str.,Ottawa.
The Wakefield Mica Co., 354, Wellington Str., Ottawa.
Lila Mining Co. (D. L. McLean), 5. Sparks Str., Ottawa.
Chs. Guertin, 398, Wellington Str., Ottawa.
E. B. Haycock, 49, Cooper Str., Ottawa.
The Allan Gold Reefs Co., Ltd., Victoria Chambers, Ottawa.
Webster & Co., 274, Stewart Str., Ottawa.
Brown Bros., Cantley, Ottawa Co.
Angus Cameron, Buckingham, Ottawa Co.
Lewis McLaurin, East Templeton, Ottawa Co.
Richard Moore, Pickanock, Ottawa Co.
Joshua Ellard, Pickanock.
The Glen Almond Mica & Mining Co., Buckingham, Ottawa Co.
Fleury Bros., Old Chelsea, Ottawa Co.
Edward Watts, Buckingham, Ottawa Co.
Kent Bros., Kingston, Ont.

PURCHASERS OF MICA

The Laurentian Mica Co., Ltd., Ottawa.
Sills Eddy Mica Co., 398, Wellington Str., Ottawa.
Eugène Munsell & Co., 332, Wellington Str., Ottawa.
General Electric Co., Isabella Str., Ottawa.
Webster & Co., 274, Stewart Str., Ottawa.

PHOSPHATE

J. F. Higginson, Buckingham, Co. Ottawa.

PETROLEUM

The Petroleum Oil Trust Co., Ltd., Gaspé Basin, Gaspé Co.

FELDSPAR

W. A. Allan, Victoria Chambers, Ottawa.

SULPHATE OF BARYTA

The Canada Paint Co., 572, William Str., Montreal.

PEAT

The Imperial Light, Heat & Power Co., Ltd., Liverpool, London & Globe Building, Montreal.

SLATES

New Rockland Slate Co., New Rockland, Richmond Co.

FLAGSTONES

F. R. Bishop, Bishop's Crossing, Wolfe Co.

CEMENT

Th. M. Morgan, Longue Pointe, Montreal.
International Portland Cement C., Ltd., Hull, Ottawa Co.

GRANITE

The Stanstead Granite Quarries Co., Ltd., Beebe Plain, Stanstead Co.
S. B. Norton, Beebe Plain.
James Brodie, Graniteville, Stanstead Co.
The Whitton Granite Quarry Co., St-Victor de Tring.
M. Fitzgerald, Sainte-Cécile, Compton Co.
Jean Voyer & Fils, Rivière à Pierre, Portneuf Co.
Joseph Perron, Rivière à Pierre.
M. P. Davis, 48, Central Chambers, Ottawa.
J. Brunet (Laurentian Granite Quarry), Côte des Neiges, Montreal.
J. A. Nadeau, Iberville.

BRICKS—(The principal companies)

The Montreal Silicate Brick Co., Ltd., Montreal.
Thos. W. Peel & Co., Montreal.
J. Brunet & Cie., Montreal.
Chs. Sheppard & Son, Montreal.
Joseph Bernier, Montreal.
Joseph Descarries, Montreal.
Laprairie Brick Co., Laprairie.
Narcisse Blais, Quebec.
Frs. Grenon, Quebec.
Paradis & Létourneau, Quebec.
Laliberté & Fils, St-Jean Deschaillons, Lotbinière Co.
Victor Charland, St-Jean Deschaillons, Lotbinière Co.
D. G. Loomis & Son, Sherbrooke.
Eastern Townships Brick & Manufacturing Co., Sherbrooke.

LIME—(The principal companies)

Dominion Lime Co., Sherbrooke.
H. Gauthier & Cie., Montreal.
Cyrille Gervais, Montreal.
Olivier Limoges, Montreal.
Montreal Lime Co., Montreal.

To this list must be added that of companies using certain products of the mines to be manufactured in this province.

The Electric Reduction Co., Ltd, Buckingham, (ferrochrome and phosphorus.)
The Capelton Chemical & Fertiliser Co., Buckingham.
Mica Boiler Covering Co., Ltd, 92, Ann St. Montreal.
Electro Manganese Reduction Co., Shawenegan.
Standard Chemical Co. Coaticook, (acetate of lime.)
The Standard Drain Pipe Co. Ltd., St. Johns.
C. E. Dubord, Beauport, (refractary clay.)
Geo. Bélanger, Beauport, (refractary clay.)

REPORT OF THE GOVERNMENT ASSAY LABORATORY, MONTREAL

I beg to submit report of work done by me for the public in connection with amalysis of ores, mineral and waters during the year 1903. The people of the Province have apparently appreciated the low rates at which accurate analyses are made in the Government laboratory, to aid in the development of our mineral resources, which is demonstrated by the fact that during the past year (1903), 353 separate chemical determinations were made and reported on.

In addition, about 350 samples were identified and tested for casual visitors to the laboratory, and in nearly all these cases no fees were charged either for tests or consultations.

Complete analyses were made of the following materials :

Drinking waters.....	3	samples (including bacteriological examination.)
Mineral water.....	5	"
Iron ore.....	4	"
Chrome ore.....	6	"
Carbonate of lime.....	1	"

The following are the numbers of determinations made in samples received :

Gold.....	63	determinations
Silver.....	43	"
Iron.....	30	"
Titanium.....	6	"
Silica.....	12	"
Moisture.....	10	"
Chrome.....	66	"
Copper.....	21	"
Insoluble matter.....	1	"
Nickel.....	2	"
Cobalt.....	2	"
Sulphur.....	7	"
Drinking water.....	3	"
Mineral water.....	5	"
Graphite.....	1	"

Bacteria in water	3	determinations.
Phosphorus	3	"
Per cent concentrates	1	"
Manganese	18	"
Lead	4	"
Carbon dioxide	1	"
Lime	9	"
Magnesia	8	"
Alumina	6	"

A complete set of the geographical and geological maps of the province is always at the disposal of the public in the laboratory and I am pleased to report that it has been frequently made use of by visitors.

Radio-active minerals and radium having been discovered in this province by Mr. J. Obalski, Inspector of Mines, I beg to advise you that this laboratory is now prepared to make tests for the public of minerals supposed to be radio-active. The charge for the determination of radio-activity will be $1.00, and the charge for detecting the presence of radium will be $3.00. The determination of the quantity of radium in a mineral will be subject to special charge, which will be as low as possible. Arrangements have been made to have the quantitative tests for Radium made at McGill University.

(Signed), MILTON L. HERSEY,
Provincial chimist.

MILTON L. HERSEY, M. Sc., GOVERNMENT ASSAY LABORATORY,

146, *St. James street, Montreal, Que.*

Telephone (long distance) Main 252.

FEES FOR ASSAYS AND ANALYSES.

		4 Samples or less at one time each.	More than 4 at one time, each.
Gold		$1.00	$0.90
Silver		1.00	0.90
Gold and Silver		1.00	0.90
Copper		1.00	0.90
Lead		1.25	1.15
Zinc		1.50	1.35
Nickel		2.00	1.80
Platinum		2.00	1.80
Arsenic		2.00	1.80
Manganese		2.00	1.80
Chromium		2.00	1.80
Antimony		2.00	1.80
Bismuth		2.00	1.80
Silica	smelting quality of iron ores.	1.00	0.90
Iron (metallic)		1.00	0.90
Phosphorus		2.00	1.80
Titanium		1.50	1.35
Sulphur		1.50	1.35
Alumina		1.50	1.35
Ferric Oxide		1.00	0.90
Lime		1.50	1.35
Magnesia		1.50	1.35
Graphite		1.50	1.35
Moisture		0.25	0.25
Combined Water		0.50	0.50
Insoluble Matter		0.50	0.50

Identification of minerals—The laboratory is prepared to issue a report on samples, giving description as far as may be determined by rough qualitative tests, with the probable metallic contents or commercial value of the sample. A nominal fee of 25 c. is charged for each sample.

Determination of radio-activity of a mineral	$1.00
Ascertaining the presence of radium	3.00

TABLE OF CONTENTS