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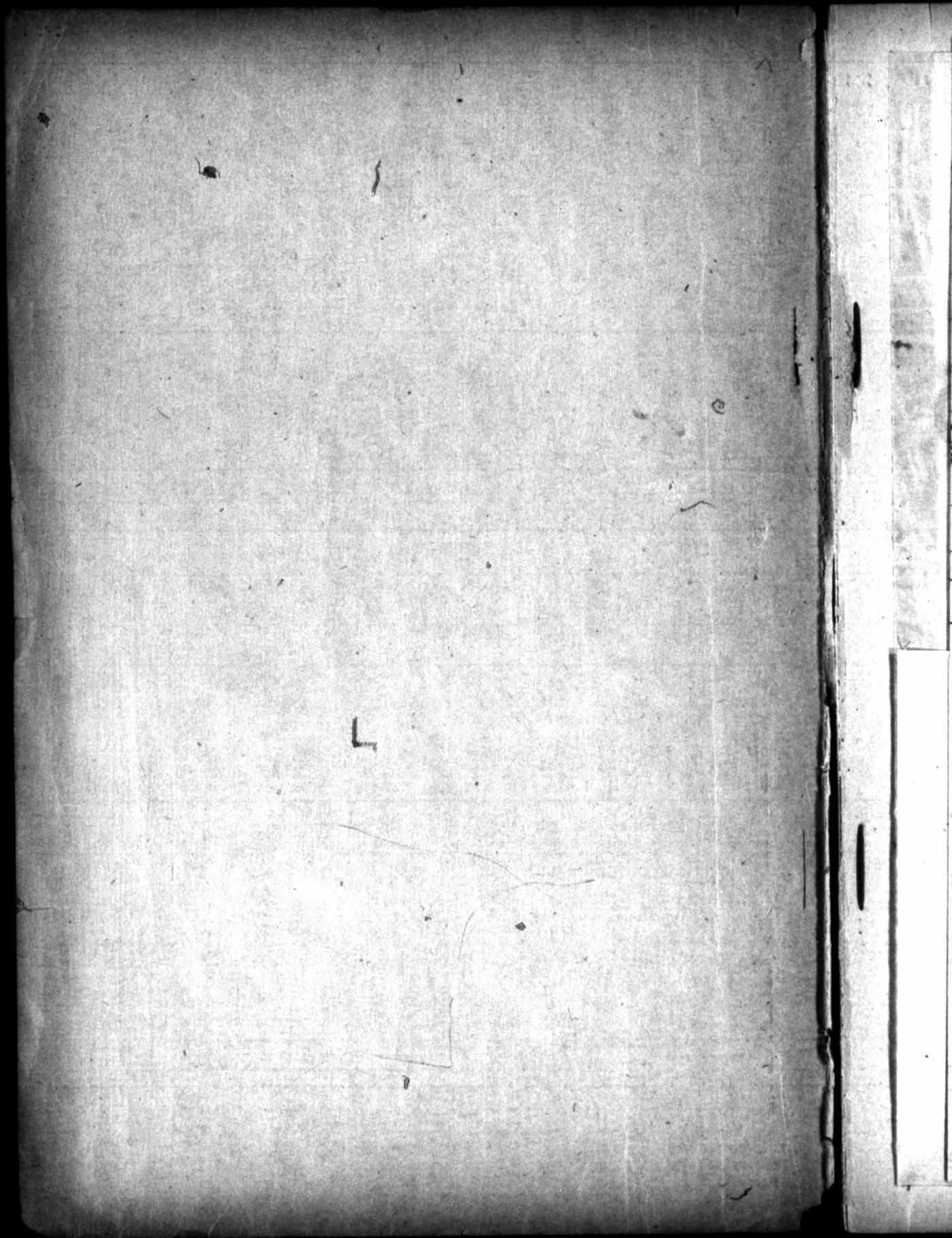
CHROMIC IRON

IN THE
PROVINCE OF QUEBEC
CANADA

BY
J. OBALSKI
GOVERNMENT MINING ENGINEER

JANUARY 1898

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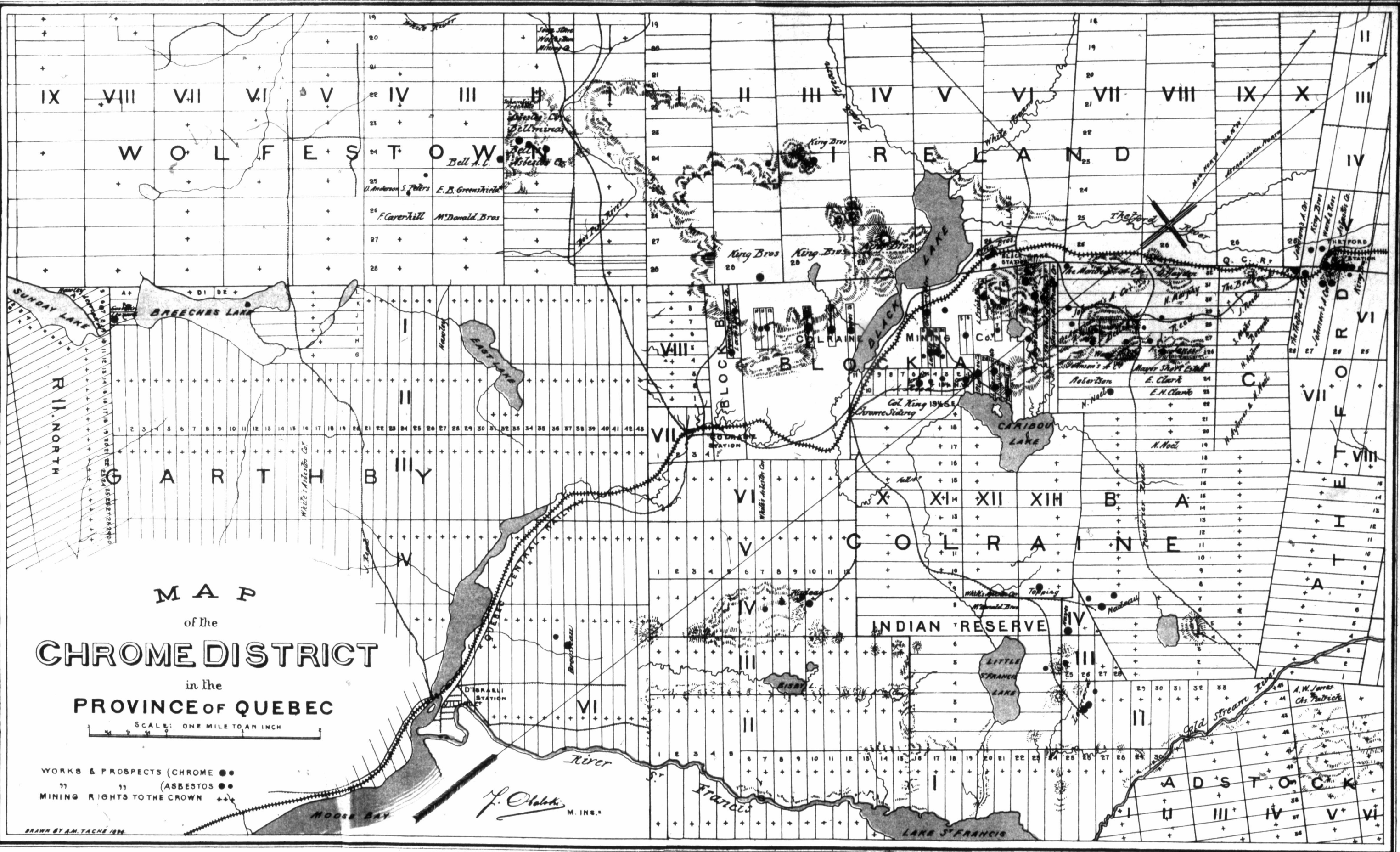
MAP
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PROVINCE OF QUEBEC

SCALE: ONE MILE TO AN INCH

WORKS & PROSPECTS (CHROME ●●)
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MINING RIGHTS TO THE CROWN ++

J. Chollet M. ING.

DRAWN BY A.M. TACHE 1894



DEPARTMENT
OF
COLONIZATION AND MINES

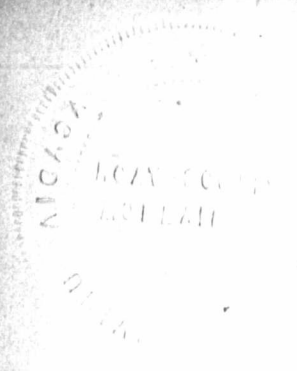
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CHROMIC IRON

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CHROMIC IRON

The existence of chromic iron in the serpentines of the Eastern Townships has long been known, but until 1894 hardly any effort was made to develop the deposits. According to the Geology of Canada for 1863, the first attempt in that direction was made in 1861, when about ten tons were extracted in the neighborhood of Lake Nicolet, (Wolfe). Some twelve years ago, a small quantity was also taken out in lot III, 24 of Wolfestown, and in 1867 Dr. J. Reed shipped to Philadelphia 54 tons derived from lot X, 1 of Leeds. Lot IV, 16 of Thetford, also yielded 4 or 5 tons, but of low grade. About the same time, specimens sent to the Antwerp Exhibition had attracted attention and orders for the ore had been received, but the known deposits did not appear to be rich enough to be worked with profit.

In April 1894, an unknown mineral having been discovered near Black Lake by a man named *Provençal*, a specimen of it was brought to my office. I at once recognized it as chromic iron of a high grade and advised that the mine should be worked, indicating at the same time where a market could be found for the product. The Nadeau-Provençal mine was thereupon opened; and the selling price of the ore being deemed remunerative, prospectors entered the field and other discoveries were made in the neighborhood, especially in the township of Colraine, thus giving rise to an industry which promises to become prosperous.

The presence of these deposits is indicated by a sort of black spongy crust, of a ferruginous aspect, appearing in spots on the serpentine and by the loose rocks found on the surface. Sometimes, the crusts are only superficial, and, at others, they penetrate into the serpentine with a thickness of several inches which may increase and attain several feet. In still other cases, the mineral shows itself at once on the surface with its metallic aspect and occasionally in its greatest thickness. But the deposits have a character of irregula-

riety they seem to be almost independent of each other and sometimes suddenly disappear without leaving any trace to warrant further work. I have never been able to observe any defined walls except the planes of ordinary fracture in the serpentine.

The question of the depth to which these deposits extend has been mooted and it has even been suggested that borings should be made to determine whether they cannot be found where they do not outcrop at the surface. I am of opinion that such deposits should exist and I have seen chromic iron found at a depth of 30' in an otherwise unproductive shaft sunk for asbestos by the Beaver Asbestos Co on lot Colrairie C. 30 ; but I think that borings would not yield great results in view of the uncertainty as regards the points where they should be made. Geologists have given considerable study to the origin of this mineral and have established in our region at least, that while it occurs in the dark green serpentines of the Eastern Townships, it is absent from the buff or honey-colored serpentines of the Laurentian system. Further, the analysis of the former shows the presence of chrome which does not exist in the latter. May it not then be supposed that it forms a constituent element of these rocks which, on rising to the surface have become hydrated, leaving isolated certain parts thereof, such as the chrome, which are only slightly or not at all susceptible of hydration? In all countries moreover, chromic iron mining has established the fact that this mineral occurs exclusively in the serpentine and in irregular pockets.

It is well therefore to recall that this principal band of serpentine, which traverses our province and includes the well known Asbestos Mines of the Eastern Townships ; appears to begin in Bolton, to the south at ranges V and VI ; partly forms the mountains of Orford ; passes to the east of Lake Brompton and thence toward ranges V and VI of Melbourne, and XIV and XV of Cleveland ; shows itself in Shipton (Danville Mine), Tingwick XI ; outcrops again in North and South Ham towards Lake Nicolet and finds its most important development in Wolfestown to the South-East of ranges II, III and IV. Then forming the mountains of Ireland and Colrairie towards Black and Caribou Lakes over a breadth of 5 to 6 miles, with a spur trending towards little Lake St Francis, and the mountains of Adstock, it is prolonged in Thetford and Broughton, where it contains the celebrated asbestos mines of Thetford and Black Lake. There is a small outcropping of it on the River des Plantes and in the Vth range of Cranbourne, on the Etchemin river, after which it is no more seen until the Gaspé district is reached, where there is a great mass of it at the head of the River St Ann and lastly a little on the Dartmouth river.

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Along the course of this band of serpentine, chromic iron exists at different points and hereto appended is a list of the lots in which it has been noted or which have been purchased to work it :

Bolton.—IV, 13, VI, 26, VII, 9 (W. Starke), 13, 26 ½, W.

Bromptou. IX, 25, 26.

Melbourne.—VI, 22 ½, N. E.

Ham South.—II, 4, 20, 21 Gosford road East, 27.

Garthby.—l. b. (Gosselin) c. (H. Leonard & Co.,) i. Island in Lake Breeches II North 5, 6, 7, 8 (H. Leonard & Co.,) 4, (M. J. Hawley) V, 36, 37 (O Brousseau.)

Wolfestown.—II, 24 ½, N. W. III, 23, 24, (Bell A. Co) 25.

Colraine.—Block A. (on both sides of Black Lake and towards Lake Caribou) (Colraine Mining Co) II, 25, 26 (H. Leonard & Co.,) III, 25, 26, (H. Leonard & Co.,) IV, 7, 8, 9, 10, (J. Nadeau & Co.,) 25, (F. Naves,) X, 19 ½, N. W. (Dr J. Reed,) 19 ½, S. E. (Col King) XIII, 5, 9, (R. Topping,) B. 6, 7, (J. Nadeau & Co.,) 23, (N. Noël,) 26, (P. P. Hall,) 28, (L. Wertheim & Co.)

Thetford.—IV, 16, (J. Reed.)

Leeds.—X, 1 (J. Reed.)

The importance of these lots varies, but nearly all of them have been more or less worked. Prospecting licenses on a large number of lots have also been issued.

At present, the principal mines at work, are in the township of Colraine between Black Lake and Colraine Stations on both sides of Black Lake and little Lake St Francis. A mine has also been worked near Breeches Lake in Wolfestown. Subjoined are a few details with respect to the principal deposits.

COLRAINE MINING COMPANY

This company owns about 5000 acres of mining lands forming blocks A and B. The lots, as subdivided by the Company, are generally two acres wide by fourteen deep and are leased on certain conditions, one of which is the payment of a certain sum, which in the majority of cases is equal to 50 per cent of the selling price of the ore delivered at the railway, and working for a certain period.

The Anglo-Canadian Asbestos Co on the same blocks is full owner of its land.

The ore from all these mines is of high grade, that is to say, 50 per cent, reaching sometimes 55 and 56 per cent. However, owing to impurities or neglect in the sorting, shipments have several times fallen below 50 per cent, thus causing difficulty with the purchaser; nevertheless, it may be said that the ore as a whole is first class and occurs in rock of medium hardness.

Actually the Colraine Mining Co has re-entered into possession of all its mines, with the exception of the P. P. Hall, W. Lambly and L. Frechette, mines and it has itself worked a lot already opened in July 1895, by Mr G. B. Hall, and situated at a couple of acres distance from the line of the Q. C. R. to the North West of the P. P. Hall mine. In 1895, it took out from it 75 tons with a few men and shipped a car load. In the summer of 1897, the Colraine Company worked for 6 months with 22 men on the same deposit which seems to be extensive and extracted about 1200 tons from two pits about 60 feet deep.

The different mines on the Company's property produced 2097 tons in 1897, of which 658 have been shipped. Since 1894 their production has been near 7000 tons, of which about 5500 have been shipped.

I append the assays of the ores communicated to me by the Company.

Analysis by the Pittsburg Testing Laboratory :

Chrome.....	39 74
Iron.....	15 20
Silica.....	1 60
Sulphur.....	0 057
Phosphorus	0 000

Corresponding to 58.06 per cent of sesquioxide of chromium and 21.70 of protoxyde of iron.

Analysis by professor Pfister of Montreal.

Sesquioxide of chromium.....	65 16 %
Protoxyde of iron.....	27 36 "
Alumina, magnesia and other matters.....	7 48 "
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The following mines are on Block A of the Colraine Mining Co.

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Lambly Mine.—Situated between lot X 19 and near the latter and the line of the Q. C. R., was discovered in 1894 by Mr F. X. Provencal, who worked it a little in partnership with Mr J. Nadeau. They took out 800 tons. This was the first chromic iron mine opened in this region. It was subsequently sold to Messrs. W. H. Lambly and others, who have taken out about 500 tons of which ore a shipment of 250 tons to Baltimore yielded of 50.3 per cent of sesquioxide of chromium. The mine comprised a surface deposit of 5 to 10 by 30 feet, with other prospects at a distance of 200 to 300 to the North East, the body being moreover traversed by veins of serpentine. Work was carried on with 20 men to a depth of from 10 to 15 feet, when the ore appears to have petered out. Nevertheless, in 1896, twenty tons more were taken from the same pocket.

This first ore pocket and its surroundings having been exhausted after producing 1300 tons yielding over 50 per cent other searches were successfully undertaken, where another large deposit was discovered which has so far yielded about 800 tons. The total output to the end of 1897 has therefore been about 2200 tons, with an average force of 15 men, and of this output 2060 tons have been shipped. The bed which is now being worked is in the form of a vein running North for a distance of 200 to 300 feet and seeming to dip 45° West, with variable thicknesses extending to 9 feet. At a depth of 65 feet, the bottom of the excavation, the thickness is less. The extraction is done by horse-derrick and the mine is at a distance of 8 or 10 acres from the line of the Q. C. R. In 1897, another pocket, adjoining this second one, was worked to a depth of 33 feet and 169 tons in all were taken out, which makes the above total of 2200 tons including 140 yet unshipped. Work is actually being carried on with 8 men.

Victoria Mine.—This mine forms the North-East limit of the Lambly mine. It was formerly known as the Jobidon mine and had remained unproductive owing to difficulties about the titles, only about 60 tons having been taken out. In June 1895, the difficulties in question having been removed, the mine was sold to Mr P. P. Hall and others of Quebec who began work in July. The work done by the job, with 4 or 5 men, yielded 112 tons of high grade ore which were shipped to Baltimore. In the commencement of September, work by the job was abandoned and the mine was worked with 15 men, the indications being always good. The mine was worked by contract, with 15 men, during part of the year 1896 and 1897 turning out 600 tons in 1896 and 534 tons in 1897. The shipments of this same year were 1066 tons of No. 1 and 32 tons of No. 2.

This mine consists of a single excavation, about 100 feet deep, in which the ore showed itself at times in masses 10 to 12 feet broad, by 7 to 8 feet high. This ore is reputed to grade 51 per cent and the output was 1300 tons. It may therefore be said that this is the largest quantity of rich ore found in a single pocket in this region. It was employed at the Baltimore and Philadelphia manufactories and by the Carnegie Company of Pittsburgh, who pronounced it to be perfectly adapted to their requirements. The mine is 8 or 10 acres distant from the shipping point of the Q. C. R., and one mile and a half from Black Lake Station.

L. Frechette Mine.—This mine, which is situated at about one mile and a half from the Lambly mine, was opened in 1895 and since worked each summer, generally by the job, its output being about 1000 tons of very high grade ore. In 1897, it was worked for five months, with 8 men, and produced 194 tons. The work consists in excavation in the flank of the mountain, the ore being shipped at Black Lake Station about $\frac{1}{4}$ of a mile off. The refuse of this mine, grading 40.76 per cent, on being subjected to concentration, gave 60.66 per cent of sesquioxide of chromium.

The Lake Caribou Chrome Mining Co.—Near Lake Caribou, worked regularly with a dozen men during the winter of 1894-95, and with five to six since, yielding about 800 tons, a part of which has been shipped. The works consist in two excavations in the mountain side.

Blondeau and Roberge Mine.—Has been worked since the fall of 1894-95 with 3 or 4 hands and has yielded about 350 tons, of which 120 have been shipped.

Dumais Mine.—Was worked during the winter of 1894-95, shut down in April and reopened in the spring with 4 to 5 men, 114 tons were shipped in 1896 and 250 in 1897, or a total shipment of 364 tons out of a total output of 500.

The last three mines adjoin Lake Caribou, at a height of 400 to 450 feet above the railway line and are in a broken, schistous serpentine, the ore occurring in blocks of various dimensions. The works are prosecuted much in the same fashion, that is to say, the deposit is struck by means of a cut made through the crumbling rock. The ore from the two first is shipped from the same point as the preceding mines, namely, at about one mile and a half from Black Lake Station, while the Dumais Mine ships from Chrom: Siding, the carriage in vehicle being about two miles in both cases and easy enough in summer, but much more so in winter. These three mines have been abandoned

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since 1896 and possession thereof has been secured by the Colrairie Company, but they can still be worked.

The three next mines lie to the west of Black Lake at altitudes of 400 to 500 feet above the lake; the serpentine there being pretty solid. They were worked a little in 1895-96 and then taken back by the Company. Transportation from them was effected for one mile and a half to Chrome Siding, but since then a road has been built to Colrairie Station, distant $2\frac{1}{2}$ miles. The ore from these three mines was of good grade and the beds important.

Lemieux Mine.—Was worked throughout the whole winter of 1894-95, with an average of 5 men, the output being about 70 tons from two excavations. The ore occurs in the form of veins, the first, solid and from 1 to 2 feet thick near the surface and the other running north for 100 feet, with a thickness of from one to four feet. In the latter, the ore possesses but little consistency and is easily reduced into sand. This mine subsequently passed into the hands of Mr. P. A. Vaillancourt, who did some work during the summer of 1895 and the winter of 1895-96. About 70 tons were shipped from this mine.

Naves Mine.—Opened in the winter of 1894-95; resumed in the month of June, 4 men being employed and 110 tons taken out, of which one carload was shipped.

L. Beaudoin Mine.—Opened in 1894 by Mr Laplante, it has since passed into the hands of Mr L. Beaudoin, who has already commenced operations with 3 men.

In the same region and a little more to the South-West, some prospecting has been done by Messrs Roberge & Frères, of Colrairie, showing the presence of chromic iron.

ANGLO-CANADIAN ASBESTOS CO.,

This Company, which has been working asbestos for over 10 years, discovered in the south western part of its territory, at a height of 600 feet above the line of the Q. C. R., a deposit of high grade chromic iron, which it has worked with a few men since the summer of 1895, taking out 675 tons of ore which were shipped from Black Lake Station.

The works consist more particularly in three excavations, descending to-

wards Lake Caribou, the deepest being about 35 feet and have been carried on with a varying force of men running as high as 25, in 1896. Ore has also been found at several other points of the property and at present there are only 3 or 4 men employed working by the job. The ore is high grade and the refuse of the mine grading 37.24 per cent, has been raised by concentration to 58.28 per cent.

J. REED.

Dr J. Reed owns lot X 19½ N. W., comprising 250 acres which he has divided into 11 claims that he leases to parties of miners in consideration of a payment of \$5 per ton for high grade, 50 per cent, and of \$3. for the inferior quality. On these terms, work was carried on by small groups of 2 to 5 men under the names of Lemieux, Fortier and Nadeau, and towards 1895 some 50 tons were taken out in this way. Mr Jos. Paré also took out 60 tons towards the close of 1896, when work was resumed by Mr *Louis Carrier*, who has continued to date with a few men and taken out 120 tons, of which about 100 are of good ore.

J. Lemelin Mine.—This mine is the most important on the Reed property and has been regularly worked since July 1894 and in 1895 with 5 or 6 men, the output and the shipment amounting to 524 tons, of which 500 were of about 50 per cent. The ore is of good grade and occurs in pretty hard serpentine. It has been followed N. E by means of a great cut of 200 feet long and of a height of 25 to 30 feet at its extremity. The ore is of varying thickness ranging to 4 feet with small deposits on the sides. A good portion of the ore was extracted and shipped during the winter of 1895-96. The mine is situated at a mile from Chrome Siding and a height of 200 feet over the railway line. In 1896, it was abandoned by Mr Lemelin.

The mines on this property lie to the South-East of the Lambly and Hall mines on the other side of the mountain and facing Lake Caribou. The ore outcrops at numerous points of the surface, besides at the above mentioned works.

These mines ship their ore at Chrome Siding, at a distance of 1 or 2 miles.

HUGH LEONARD AND OTHERS

This mine is in the centre of lot II 26, but lots II 25 and III 26, form part of the same property, consisting in all of 300 acres purchased direct from

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the government in 1894 for mining purposes by Messrs H. & J. Leonard, D. Morin and A. Labrecque. I visited it at the end of 1894 and reported on it as follows :

" The out-croppings are remarkable, the ore solid shewing on a width of 60 and a length of 150 feet with very striking indications respecting the principal deposit at 50' to the N. W. and 100' to the S. E. without prejudice to slighter indications to the North West. From a cutting 5 feet deep over 100 tons had been got out in a few blasts at the time of my visit. It has hitherto been impossible to ascertain the thickness but over the above surface solid chromic iron is observed at differences of level of 20 feet. It may therefore be presumed that the thickness is in proportion to the other dimensions and we have a relatively considerable quantity of ore which justifies the work that is being done there and the building of a road 6 miles long to transport the ore to the Q. C. R., between Colrairie and Black Lake stations."

A siding has since been built at Chrome Siding. " It may therefore be stated without exaggeration that there are several thousand tons of ore in sight even admitting, only a slight thickness. No shipments have yet been made from this mine and consequently its merchantable percentage is not known, but if it reaches 50%, it will pay very well to mine this deposit."

This mine was afterwards worked during the winter of 1894-95, up to April with 5 men only. A good winter road was made ; houses and stables were built at both ends and 1100 tons were extracted and carted to the railway; 600 tons of which were shipped including over 400 that went to Europe. These 1100 tons were extracted at the surface only from an excavation measuring 50' x 20' and of a depth of 12'. The quarrying and cartage were effected at an exceptionally cheap rate. Work was resumed at the beginning of September 1895 with a view of baring the deposit still more and of preparing for extraction during the following winter 1885-96, during which 900 tons were taken out.

Work was carried on during 1897, and a quantity of 1500 tons was transported. Thus 2500 tons in all have been extracted with a maximum number of 15 men of which 1700 had been shipped up to the 1st January 1898.

Owing to the facility with which operations can be carried on, this mine is worked with a few men only and as the surface is cleared in the autumn, all that has to be done in winter is to quarry the ore and put it into vehicles, as transportation is much more easily and more cheaply effected at that season.

As was expected, this deposit is very considerable but the percentage of the ore is low, about 40% ; nevertheless some parts of the deposit have yielded 44%. The ore was shipped to England and to Pittsburg and was employed in the manufacture of refractory bricks and in large blocks used in the construction of portions of metallurgical furnaces exposed to high temperatures.

This company is the same as the one which owns the Garthby mine that will be referred to further on. It also controls a certain number of lots in the same district.

J. NADEAU AND OTHERS (CANADIAN CO.)

Colraine B. 6. 7.—This mine was opened in the autumn 1896, the company having obtained from the government lot 6 (100 acres in full ownership) and $\frac{1}{2}$ of lot 7 (50 acres) under mining license. It has only been prospected but gives very fine indications of chrome over a surface of from 15 to 20 acres on which excavations have been made showing chrome at a depth of from 1 to 9 feet, chiefly on lot 7. The depth of these prospects does not exceed a dozen feet with the exception of one shaft of 25 feet : according to the surface indications, several seem to be in the same mass of ore. It is therefore probable that additional working will bring a large deposit of chrome to light. Hitherto only a few men have worked there at irregular intervals and about 80 tons have been taken out, 50 of which were taken to Chrome Siding situated at a distance of $4\frac{1}{2}$ miles from the mine.

Colraine IV 9 and 10.—The same owners also worked this mine which is at the side of a hill 400 feet high and $2\frac{1}{2}$ miles from Chrome Siding. An excavation was made about a hundred feet long and 12' x 15' showing good indications from 1' to 4' thick and out of it 185 tons were taken in the fall of 1896 and conveyed to the station : 54 tons were shipped. A selected sample yielded 50.76%. In addition to that work, other good surface indications are to be observed, especially on lot 10.

P. P. HALL

Colraine B. 26.—This mine which belongs to Messrs Ward & Ross, has been leased to Mr P. P. Hall who has cleared an important deposit and who continued to work at it. 200 tons, a portion whereof was of high grade had been taken out up to the 17th January 1898, and 36 tons were shipped to Pittsburg. The mine, situated about a mile and a half from Black Lake Station, was opened on the 20th November 1897 with 15 men. It

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gives very good indications and will be regularly worked throughout the winter. A selected sample yielded 53.6% and an average sample out of 80 tons 50.67%.

OTHER MINES.

In the township of Colrairie chromic iron has also been found in a certain number of lots in which some slight mining operations were carried on,

R. Topping Mine XIII 9.—This was worked in the winter 1894-95 with 3 or 4 men and yielded about 50 tons which were shipped.

F. Naves Mine IV, 25.—The work on this mine that had been suspended was resumed at the end of 1895 with a few men, then was finally abandoned after 25 tons of high grade ore had been extracted and shipped.

Chromic iron has also been found in lots III, 25. (Lapierre) XIII, 5. (Lamarche) IV, 9, 11—B. 10. B. $\frac{1}{2}$ S. W., 28. (Louis Wertheim & Co) B. 23; but prospecting only has been done on these lots, however, from this last lot Mr Blondeau took out in the autumn of 1897 about forty tons of low grade ore and the deposit seemed to be a considerable one.

GARTHBY

H. Leonard Mine I. C.—Was regularly worked since the autumn of 1894 with 4 or 5 men and yielded 400 tons of very high grade ore which were shipped; some shipments having yielded as high as 55%. The mine is 9 miles from d'Israeli station and to reach this, Lake Breeches has to be crossed. It has been shut down since 1896 on account of water in the pits. The work on this mine consists of a couple of sloping excavations on the side of the hill which followed the lead of the ore but which are now filled with water. The ore is very soft and has to be shipped in sacks. Messrs Leonard and others acquired the land from the Government as well as part of lots 5, 6, 7, 8 of range II north to the north of Sunday lake forming an area of 176 acres, but only a little work has been done on lots 6 and 7 from which about thirty tons were taken out in 1896 by Mr Roch Gagne.

Gosselin and Sons Mine.—Lot I. B. was purchased from the Government by Messrs Gosselin who have done some prospecting there as well as upon lot C.

In the same region we must mention a small island in Lake Breeches on which a deposit of chromic iron has long been known to exist and which has not been worked.

O. Brousseau Mine.—This mine is on lot V. 37, one mile from the Q. C. R., and two miles from d'Israeli village. It consists of a somewhat considerable deposit on the summit of a hill which also covers lot 36. The ore is hard and generally low grade, about 40%, an assay however yielded 44.1%. An experiment of concentration brought it up to 51%. About 35 tons have been extracted and 20 tons have been shipped from this mine.

OTHER TOWNSHIPS

In *Bolton* during the winter of 1896-97 a little work was done at lot VII 9 by Mr Wm. Stark who extracted 27 tons and shipped them to Liverpool. Only a small excavation was made in a fine variety of serpentine which shows good indications of ore. A sample taken by me yielded 49%. The band of serpentine in this region is rather considerable and of fine appearance and perhaps may contain some deposit worth mining. The mine is 4 miles from Eastman station (C. P. R.)

In the same townships, in the vicinity of Lake Memphremagog, a block was found long ago weighing several hundred pounds.

In *Brompton*, Mr J. Mc Caw has done some prospecting in the vicinity of Lake Brompton, IX, 25, 26, and states that good indications have been found but he has not shipped any ore.

In *Ireland*, chromic iron has also been found not far from Colraine line on the lands of Messrs King Bros, especially in ranges II and III. In 1895 Mr Gardner did a little work on lot II. 28 and extracted about 50 tons from it

In *Wolfestown*, ore has been found on lots II, 24, III 23, 24, 25. About 30 tons were taken out some twelve years ago from the land now owned by the Bell Asbestos Co. (III, 24) where chromic iron was found over a distance of 600 feet sometimes of a thickness of from 3' to 5'. Still more recently some prospecting has been done on lots III 23, IV 26, and small quantities have been found but although it shows fairly good indications, this district, situated 5 miles from Colraine station, has not been otherwise developed.

In *South, Ham* Mr R. Leckie in 1861 extracted from Lot II, 4, about ten tons from a deposit from 3 to 4 feet thick. According to the report in the *Geology of Canada* this ore contains a percentage of 43.9%, and it was offered in England at from £11, 10 stg to £12 per ton. These figures seem to be exaggerated and there is doubtless some mistake. Shipments at that time were

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made via Arthabaska Station (G. T. R.) Good deposits have also been found in lot 27 east of the Gosford Road as well as in lot II, 20, 21. These mines are about 12 miles from Garthby station but are not worked.

In *Leeds*, X. I, in 1887. Dr Reed got out 54 tons of high grade ore of 51, 52% which were shipped to Philadelphia from Robertson station and were paid \$25.00 per ton f. o. b. In *Thetford* IV 16, some tons have also been extracted but the ore was low grade.

In the summer of 1897. I explored a mass of serpentine of considerable extent forming *Mount Albert*, at the head of the Ste Anne des Monts river in Gaspesia. The summit of this mountain which is 3700 feet high consists of a vast bare plateau of not less than 25 square miles. I found some small pieces of chromic iron and light veins of from 2 to 3 inches but I saw nothing there to justify work being done or even any prospecting. Moreover that region which is situated at a distance of 25 miles from the Gulf of St Lawrence is very difficult of access. A strip of hornblend, very black and heavy, may have been taken by the inhabitants for iron.

SMALLER DEPOSITS

In addition to the deposits above indicated several exploration licenses have been obtained from the Government and a good deal of prospecting has been done on lots that have since been abandoned but that may later on be developed by labor on a larger scale

I must also mention some points where chromic iron has been found mixed with other ores, magnetic iron in particular.

To the north of Lake Nicolet on lot I, 21 $\frac{1}{2}$ W, of *South Ham* belonging to Dr J. Reed there is a remarkable deposit consisting of a vein of magnetite iron, containing 4% of sesquioxide of chromium. This vein which is very regular is found at the contact of the serpentine and cambrian schists. It is observed for a distance of 200 feet by an outcropping running in a N. W., direction and varying in thickness from 6 to 13 feet. A shaft 12 feet deep has been sunk whence about a hundred tons of good ore have been extracted; at the bottom the vein is 9 feet wide. The ore is covered with a layer of carbonate of copper. The mixture of these ores is interesting to study and may have some importance. The mine is about 12 miles, from Garthby Station (Q. C. R.)

In Colraine XIII, 2, 3, (Indian reserve) chromic iron is found mixed with magnetic iron. This property belongs to H. Leonard & Co.

In Broughton VII, in the centre of 13 chromic and magnetic iron are also found in the vicinity of the asbestos mines.

We have not recommended the mining of these deposits for chrome.

MINING, LABOUR, TRANSPORT.

As already stated chromic iron is found only in pockets of irregular shape scattered throughout the serpentine. This rule is confirmed in our districts and for that reason the work has been done in an elementary fashion. When outcroppings of that ore are found the surface of the rock is cleared. This is easily done for the hills of Colrairie are bare of trees and the layer of soil is very thin. The mining is then done in the open by following the ore either by means of a trench or a simple excavation. When the pocket is exhausted it is abandoned and another is opened. It frequently happens that a series of pockets are found following one another or in close proximity.

The question has been raised as to whether it would not be advantageous to sink deeper shafts in the serpentine or borings, with the object of discovering pockets that do not crop on the surface. It is more probable that chromic iron may be found in that manner and I refer to what I have already said on the subject. The greatest depth hitherto attained is about 100 feet at the Victoria mine which is the most considerable pocket ; it has already yielded 1300 tons. The Leonard mine at little Lake St Francis has yielded nearly 3000 tons and promises to yield much more ; its depth does not exceed from 20 to 30 feet.

These mines have had but little or no water ; the rock is fairly solid and the nature of the excavations needs no timbering. Most of the mining has been done by small parties of men dwelling in the vicinity. No mine employs more than twenty-five men and in all there are about 60 to 80 men employed during the fine season ; some of them however work during a part of the winter. These mines are scattered along the Quebec Central Ry., between Black Lake and Colrairie stations at a distance generally of from a few hundred yards to a mile, but in some cases from 6 to 9 miles further than Chrome Siding. In the former case cartage is effected at all seasons but in the others it is easier in winter. The mines do not use any steam engines but only horse derricks in some cases.

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In the case of the present good deposits the cost of extraction and cartage may vary from \$1 to \$8 per ton and the freight to the railways from 30 cents to \$2.00 not including, of course, the cost of installation, road-making general expenses &c. All the figures given in this work apply to the ton of 2240 lbs.

On an average, \$5.00 is reckoned as the cost of extracting and carting to the railway; labor costs from \$1.50 to \$2.00 for skilled workmen and foremen and from \$1 to \$1.25 for miners; 80 cents to \$1.10 for laborers and 30 to 60 cents for children employed sorting; the day is of ten hours.

Several mines are worked by contract taking \$5.00 per ton as a basis for ore delivered at the railway under ordinary conditions.

STATISTICS

	tons.
Shipped before 1894 from Leeds.....	54
Shipped in 1894 to United States (Baltimore and Philadelphia).....	915
In 1885 to Philadelphia.....	807
do Baltimore.....	725
do Pittsburg.....	810
do Liverpool (England).....	400
do Glasgow (Scotland).....	41
do Nova Scotia.....	54
	2837
In 1896 to Philadelphia.....	750
do Pittsburg and vicinity.....	1232
other points.....	55
	2037
In 1897 to the United States and chiefly to Pittsburg..	2340
	8183
Total shipped.....	
On the 1st January 1898 there were also on hand ready for shipment more than one half being high grade..	2000
	10183
Total yield.....	
Or in round numbers over.....	10,000 long tons.

In the Ottawa Tables of Trade and Navigation we have the following figures for the exports during the years ending 30th June.

1894-95—2414 tons of 2000 lbs. worth.....	\$	37345
1895-96—2934	do	39964
1896-97—2048	do	24487

COMPOSITION AND ANALYSES

Chromic iron or *chromite* has a density of 4.5, say about 7 cubic feet per ton, its hardness is between 5 and 6, it gives a brown stripe and dust; it is unattackable by acids and infusible at the highest temperatures. Some authors say that it is sometimes magnetic, but I did not observe that it was so in our region. It is true that some samples of magnetic iron in the serpentine contain chrome but I consider, at least for our district, that its non-magnetic condition is a distinguishing characteristic of ores that can be worked for chrome, its appearance moreover is that of magnetic iron or titanite iron. It is composed of iron in the state of protoxide and sesquioxide of chromium; nevertheless the elements, iron and chrome may be, in part, replaced by magnesia and alumina, which then reduce its grade, without prejudice to the mixture with the serpentine, which is moreover easy to discern. Theoretically it may be said that the yield in sesquioxide is 68 per cent, but it is rare for the real grade to exceed 56 or 57 in picked specimens and the industrial tests on shipments very seldom reach 53 or 54. The merchantable grade for the manufacture of bichromate of potash is 50, but some buyers accept 49 and even 48. Under that, the ore is classed as of inferior quality. The Black Lake ores have given 49.8 and 50.3 on shipments (Analyses of the Baltimore chrome works) and 54 and 56 on specimens (Donald Analyses) 58.06 (Pittsburg testing laboratory) concentrated specimens from Black Lake 56.28 and 60.66 per cent (Ledoux & Co). Mr. Milton L. Hersey has also made numerous analyses of these ores, which frequently gave high grade. Shipments from Breeches lake have reached 55%.

In chemical industry, the ores which are poor in silica are preferred and for certain uses buyers fix a limit of 12½ per cent of metallic iron and 8 per cent of silica.

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USES

Chromic iron is used for the manufacture of bichromates of potash and soda which are employed in the dyeing and printing of calicoes. These products form the bases of the chrome colors, yellow, orange, green, &c; they are also utilized in the construction of certain batteries of electric piles, in the tanning of leather, in chemistry and slightly in medicine. Chrome enters into the composition of the ferro-chromes which are used to make the chrome steels that are noted for their very great hardness and employed for the armor plating of vessels and forts and for the making of shells, tools for cutting iron, shoes and dies in stamp mills, safes &c. Ferro-chromes of different grades, ranging from 40 to 90 per cent of chrome, are made while the chrome steels contain from 1 to 10 per cent of chrome. They are also employed in alloys with aluminium. Metallic chrome has been isolated, but it is not to my knowledge that it has been used industrially.

Chrome imparts to the metals with which it is allied great hardness and inalterability and increases their elasticity, these qualities varying with the grade in chrome.

More recently low grade chromic iron has been employed on account of its essentially refractory qualities, in the construction of certain parts of furnaces exposed to high temperatures and especially in the construction of the inside parts of open heart furnaces and of reverberatory furnaces for copper smelting. A certain quantity of it is regularly used for this purpose, in the Pittsburg district where also special chrome fire bricks are manufactured, two companies being engaged in this industry. In this case, the medium grades are preferred on account of the price. In latter years about 2000 tons have been used in the United States for these purposes. It is also employed by the European metallurgical establishments.

MARKET

Three years ago, chromic iron of 50 per cent was worth \$20 to \$21 per gross ton f. o. b. Q. C. R., but the current prices are lower and \$18 may be considered the maximum actually paid for that quality, with an ascending scale of 50 cents per unit. There is hardly any sale for poor ores, but \$8 to \$10 may be taken as the basis of the price of 40 per cent ore. There is more demand for ores grading about 45 per cent at the prices ranging between the two above extremes.

Under the Mc Kinley tariff, there was a duty of 15 per cent ad valorem, which was suppressed by the Wilson tariff and at present there is no import duty in the United States. Railway freight costs per ton, for a full car \$5.50 from Black Lake to Baltimore, and \$5.00 to Philadelphia. I do not know the exact rates for the Glasgow markets, but a price of \$22.50 is mentioned, the freight charge being \$4.50.

The following table shows the situation in the United States during recent years :

	Production.	Imports.	Consumption.	
1893.....	1629.....	6354.....	7983	long ton
1894.....	3285.....	3886.....	7171	
1895.....	1553.....	5230.....	6783	
1896.....	702.....	8869.....	9571	
1897.....	50.....			

I am told that the Baltimore and Philadelphia manufacturers annually consume from 5000 to 6000 tons of superior grade, the remainder being employed in metallurgy and the manufacture of refractory materials. The entire world's consumption, would appear to amount to from 25,000 to 30,000 tons, of which about one half is supplied by Turkey.

In the United States, there are two bichromate of potash factories :

- Baltimore Chrome Works (Tyson & Sons), Baltimore, established in 1844.
- Kalion Chemical Co (Harrison Bros.) Philadelphia, " 1880.

The following companies employ chromic iron in metallurgy,

- Brooklyn Chrome Steel Co., Brooklyn.
- Carnegie, Pittsburg.
- Bethleem Steel Co., Bethleem.

In Europe, Glasgow (Scotland) seems to have been and is still the leading centre of this industry, the buyers of ores, whose names we can mention being :

Stevenson, Carlyle & Co.

J. & J. White, the oldest established house for the manufacture of bichromate of potash.

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We have little information relative to the industry in Europe, but there are manufacturers of bichromate in England, Russia, Germany and Norway.

CONCENTRATING

The chrome ores from the environs of Black Lake are generally of high grade, but must be hand picked, from which result loss and uncertainty in the grade. Some low grade deposits are also found in the same region. But if a ready market can be found for the 50 per cent grade, the case is not the same for the lower grades and this industry therefore has no future before it except through the systematic concentrating of the poor ores and the refuse. In order to ascertain if our ores were adapted to this operation, it was purposed to employ the Castelnau table and the Edward P. Allis Co of Milwaukee put up a special plant composed of a Blake rock crusher, a crushing roller, a Bayley grinder and a Castelnau table. Leaving the grinder, the ore passed through a metallic cloth of 35 meshes. In some of the last tests I used a mesh of 18. Subsequently it was proposed to use the Chilian mill instead of the Bayley grinder, to secure more effective work. The Castelnau table is composed of an endless rubber sheet, inclined laterally. The ore is fed at one end and in moving with the sheet meets a water surface which owing to the lateral slope removes the lighter parts, the pure ore only being carried to the other end by a stronger current of water.

I tested 9 different kinds of ores and the results obtained were as follows :

Grade of the Raw Ore	Grade of the Concentrated Ore
40 16 per cent	51 12 per cent
40 64 " "	42 94 " "
34 88 " "	49 42 " "
39 58 " "	48 80 " "
42 66 " "	42 01 " "
28 68 " "	45 70 " "
38 34 " "	48 90 " "
37 24 " "	56 28 " "
40 76 " "	60 66 " "

For my tests which were made in quantities of one to two tons, I selected

the poorest ores or the refuse of the mines. Now we only see two specimens whose concentration was not satisfactory and I even believe that these two results are due to special causes independent of their quality. It may therefore be claimed that the result as a whole was good and that it has proved that our ores can be concentrated economically.

I paid special attention to the concentrating itself and allowed the first tailings to go, but they would have to be re-treated. I therefore saved only 33 per cent of concentrated, certain specimens having given as much as 45 per cent, but I estimate that the complete treatment would give 66 per cent in the case of 40 per cent ores concentrated to 50 per cent and in these cases it would cost \$3.30 to turn out a ton of concentrated ore or \$6.60 for two tons derived from three tons of poor ore. Assuming a selling price of \$18 per ton of 50 per cent f. o. b. Q. C. R., we get $\$18 \times 2 - \$6.60 = \$29.40$, produced from three tons of poor ore. Putting the average of the cost of extraction at \$5, there remains $\$29.40 - \$5 \times 3 = \$14.40$ or \$4.80 of profit per ton of poor ore which is a sufficient margin for a company owning the mines and a mill.

According to a specification prepared by the Allis Company and to my own calculation, complete works for the production of ten tons of concentrated per day of 10 hours would cost about \$15,000. Lake Caribou, which is at an elevation of one hundred feet above the line of the Q. C. R., could furnish the necessary water for the treatment of the ore. I hope that some company will be tempted to take the initiative of establishing concentration works which will aid the development of this industry, by rendering saleable the inferior ores which do not find a ready market.

A mill of this kind might be established near the line of the Q. C. R., between Black Lake and Colrairie stations.

LEGISLATION

The chrome region in the province of Quebec, being wild and barren, the lands which are still numerous, and subdivided into lots of 100 acres, with a length of one mile, are not sold for agricultural, but for mining purposes. Prospecting licenses, good for three months, can be obtained at the price of \$5, per 100 acres and give the holder the privilege of purchasing. Mining licenses are also issued on payment of a fee of \$5 and an annual rent of \$1 per acre, the law fixing no minimum as to area, but only a maximum of 200 acres.

The latter price in the surface and 400 acres by law. A requisite fee after a sun years.

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The latter licenses are renewable indefinitely. To buy the lands out, the price in the case of chrome is \$4 per acre, carrying with it both ownership of surface and the mining right. A minimum of a 100 acres and a maximum of 400 acres per individual or of 1000 acres in the case of a company are fixed by law. Applications must be made to the Government accompanied by the requisite fees and by specimens. The patent or definite title is only granted after a sum of \$200 has been expended on development within a delay of two years.

MAP

The annexed map, which accompanies this work, should be considered rather as a diagram showing the lots still belonging to the Crown; nearly all the ground embraced in the map is covered by serpentine and the accompanying diorite. The entire township of Colraine being absolutely wild, the roads marked are partly winter roads for the use of the mines; the road between Black Lake and D'Israeli is good in winter and about passable in summer to Colraine; that from Black Lake to Thetford is good at all seasons. The Poudrier road is an old Government road, but long abandoned, nothing but a foot path remaining. The country is mountainous and the shadings on the map only imperfectly indicate the surface undulations. The highest points are near the little lake to the N. W., of Lake Caribou and at the W. angle of block A, 800 feet above the level of Black Lake. Black Lake station is 160 feet above the same level and Lake Caribou 215 feet. Adstock Mountain is 1800 feet above it.

CONCLUSION

According to the foregoing it will be seen that in the Province of Quebec there is a pretty extensive region in which chromic iron occurs in commercially workable quantities and when it is considered that these deposits are located at distances ranging from several acres to five and nine miles from the line of the Quebec Central Railway and on heights which render their working easy, that labor on the spot is cheap and fuel wood close at hand, I am inclined to think that it would be difficult to find a more favored country as regards this industry. It has been prosecuted there since 1894, but by very primitive methods, not a single steam machine having been yet employed; nevertheless over 10,000 tons have been taken out to a value of about \$140,000. Nova

Scotia coal is worth \$4.00 a ton at the Quebec Central Railway. Further more, the chromic iron ores of the region in question are concentratable and capable of furnishing a very large quantity of high grade. By the annexed map it will be seen that the Government still owns many lots, which can be fully bought out at \$400 per 100 acres. There have been no deep workings yet and it is safe to conclude from what has been said that this district is destined to become an important factor in the production of chromic iron for many years to come.



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HISTORY

For a long time chromic iron was regarded only as a mineralogical curiosity and its industrial use only became known when it was applied to chemical industries.

The application of the salts of chrome to dyeing dates from 1820 and the industry of the manufacture of bichromate of potash was inaugurated about that time. It was only in 1883 that potash was partially replaced by soda. Down to 1827, the very limited consumption of this product was supplied from the region of the Ural Mountains. In 1827, chromic iron was discovered by Mr Isaac Tyson Jr. in the neighborhood of Baltimore and subsequent search resulted in further discoveries of it in other parts of Maryland and Pennsylvania. From that time to 1862, the Baltimore region supplied the market in the United States and Europe, the most important centre of consumption in the latter being Glasgow. In 1845, Mr Tyson, in order to utilize his surplus output, established the manufacture of bichromate of potash, which is still in operation in Baltimore under his direction. In 1848, the deposits in Asia Minor were discovered, which, ten years later, became, so to say, the most important factor in the production of chrome in the whole world. In 1869, discoveries of the ore were made in California, which have supplied the American industry from 1878 down to these latter years and next in New South Wales and New Caledonia and lastly in Canada and Newfoundland in 1894.

The manufactory in Philadelphia was started in 1880 by Messrs Harrison Bros.

COUNTRIES PRODUCING CHROMIC IRON

I append some information relative to the other countries which produce chromic iron, which are taken from various papers and special publications, but are well summed up in the different volumes of "*The Mineral Industry*" of New-York, which also furnishes very interesting details on the making of bichromates, the concentration of the ore, their analyses, etc. As already stated, these ores are always found in the serpentine.

PENNSYLVANIA AND MARYLAND, U. S.

These two States were for a long time very important producers of chromic iron. In 1827, chromic iron 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 this mineral, producing over 100,000 tons. A notable fact about this mine was that it showed no outcropping, the paying deposit having been struck at 8 feet beneath the surface. In the same region, near Baltimore, the mineral was found in the form of sand and was concentrated without difficulty. Subsequent search led to the finding in Lancaster County Pennsylvania, of the Wood mine, which also became the property of Mr Tyson. This mine was regularly worked from 1828 to 1880, except from 1868 to 1873 and produced a quantity which in 1880, was estimated at 95,000 tons. During the last years, the annual output was only a few hundred tons. The depth reached was 700 feet and the mine was developed by regular levels.

Other mines of less importance were also worked in the same regions and I refer the reader to a remarkable work by Mr W. Glenn, of the Baltimore Chrome Works, which embraces a complete history of the industry (Transactions of the American Institute of Mining Engineers, October 1895,) and also " United States Geological Survey, Chromic, Iron, with reference to its occurrence in Canada " by the same author.

Chromic iron has also been found in Virginia, North Carolina and Vermont but I am not aware that it has been mined there to any notable extent.

CALIFORNIA

In the Santa Lucia mountains, to the north west of the county of San Louis Obispo and in other adjacent counties, numerous deposits of chromic iron, often of low grade and silicious, have been found. These mines were discovered in 1869 and the manufacturing companies of Baltimore and Philadelphia acquired the control of several of them. Since 1878, these mines have been worked somewhat regularly and have produced an average of 2000 tons a year until late years, making a total output of about 36,000 tons. Concentrating tests have been made there, which seem to have produced fairly good results, the grade of some of these ores having been raised to 50 per cent. But the difficulties of transportation and the long distance to the points of consumption appear to have affected the development of the industry, as the output of late years has already fallen off and, in 1897, the official statistics only show a production of 50 tons. The public information supplied relative to the region in question indicates that the works have been completely stopped.

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NEWFOUNDLAND

Chromic iron is further found on the west coast of Newfoundland, at Bluff Head, Port au Port Bay, where a very important bed is being worked by the Halifax Chrome Company, which during the Summer of 1896, took out 1500 tons and shipped about 200 gross tons, of which 145 went to Pittsburg where it yielded 49.90 per cent (Transactions of the American Institute of Mining Engineers, Geo W. Maynard February 1897.) The author of this paper says that the ore gives from 39 to 50 per cent and he mentions the discovery of a mass of 97' long by 45' wide. I visited this mine in 1894 before it was opened and I noted its value and the fact that it could be profitably worked, if shipments could be made easily. It was worked in 1897, producing about, 3000 tons, none of which was shipped.

ASIA MINOR AND SYRIA

Chrome was discovered in 1846 in the neighborhood of Brusa and other places in the environs, but the actual mining centres are now more to the South, the shipping ports being Makri, near Smyrna, and Ghemlek, near Brusa, the ore being transported on the backs of camels for a pretty long distance. These deposits have only been worked regularly since 1855 and from that time they have been the principal sources of supply for the European and American markets. The ore brought to the United States is of high grade and very good quality, ranging from 50 to 54 per cent.

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

The most important deposits however appear to be those of Brusa district which, owing to their high grade and low prices of labor, can be worked and transported with profit.

MACEDONIA

High grade ore is worked in this province towards Monastir and Kossovo, the shipping port being Salonica. The shipments foot up to several thousand tons a year. We have no positive information about that country.

NEW SOUTH WALES (AUSTRALIA)

This mineral was worked in 1882 and an attempt was also then made to export it, but it was not till 1892 that the mines were developed to any extent. In 1894, they became important, for we note during that year an export of 3034 tons of a value of £12336, the total output of 7 mines to February 1895, being 4525, of which 1250 were yielded by one of them. The ore was shipped from Sydney to England, and the cost price, delivered at Sydney, ranged from \$6 to \$9. The ore seems to be high grade and the deposits abundant. The districts worked are Gundagai and Tumut. We have no other information since 1895.

NEW CALEDONIA

Workings for this mineral have been carried on since 1875. The deposits are not far from the sea shore and appear to be of high grade, the cost of the ore grading 50 per cent, delivered at Noumea, being estimated at \$8. Deposits in the form of sand have also been found.

NEW ZEALAND

Deposits have been discovered which have been slightly worked from 1858 to 1866, producing from 5000 to 6000 tons of seemingly high grade ore.

NORWAY

Small quantities have been discovered in the neighborhood of Drontheim and Roeraas, which have been slightly worked, the shipments never exceeding 400 tons a year.

AUSTRIA

In Bosnia, there are some rich ores, but often much mixed with the rock. These were concentrated by simple washing after crushing; the out-put being only a few hundred tons a year; in 1894 it was 1808 tons. Chrome is also found in Moravia, Styria and Hungary, but the deposits were of less importance.

For a long time the Caucasus has been the manufacturing center of bichromate, which

In addition to the low grade ores there are iron ores

The principal product of the furnace (the pyrites or sulphate) are concentrated in mass and treated with chromic acid. It is then treated with water and is concentrated by the formation of bichromate when crystals of sulphate of potash

The treatment is deliquescent, and not crystalline in consequence of the impurities performed but different materials and the crystals of reactive acids. On this question, high grade ores

The chrome is and mixed with expensive art

RUSSIA

For a long time, the existence of chromic iron in the Ural Mountains and the Caucasus has been known and, down to 1877, shipments were made to the manufacturers, but quite recently an establishment for the manufacture of bichromate, which uses up 2000 tons a year, has been opened near Elabourgi.

In addition to the foregoing countries, Silesia may be mentioned, where low grade ores have been found, the working of which has been abandoned. The mineral is also found in Greece and Hungary; also in Tasmania where there are iron ores containing some units only of chrome.

MANUFACTURE OF BICHROMATES

The principle of the manufacture consists in heating in a reverberatory furnace the pulverized ore mixed with a salt of potash or soda (carbonate or sulphate) and with slaked lime; the object of this last being to separate the mass and to prevent solidification. In the oxidating flame of the furnace, chromic acid is produced and with the potash forms a chromate. The product is then treated with boiling water which dissolves the chromate and this liquid is concentrated by heating it, when sulphuric acid is added to provoke the formation of bichromate and sulphate of potash. It is then left to crystallize when crystals of bichromate of potash are obtained, the liquid containing the sulphate of potash being treated to utilize that salt.

The treatment for bichromate of soda is the same, but this salt, being deliquescent, that is to say, easily absorbing humidity from the atmosphere and not crystallizing in the same fashion, the final operation has to be changed in consequence. This resumé will give a general idea of the operations to be performed but the work is very delicate owing to the proportions of the different materials employed, the action of the furnaces, the temperature, the filtering and the crystallization of the liquids and the proportions of water and of the reactive acids, &c. The limits of this work do not permit of development of this question, but I deem it right to call attention to the reasons which make high grade ores desirable in this industry.

The chromic iron is pulverized apart so as to pass through a mesh of 80 and mixed with a certain proportion of carbonate or sulphate of potash (an expensive article) and of lime. The great point is to transform in one opera-

tion the whole or the greater part of the chrome and as the cost of fuel and of labor and then of the subsequent operations are the same, it will be understood that the profit will be proportionated to the quantity of useful matter secured ; whence the motive for having the best raw material in point of richness and adaptability to treatment (Mineral Industry, 1895).

This industry is very complex ; many patents relative to it have been taken out, just as each factory has certain processes which are kept secret. In all cases it calls for great practice and great skill both on the part of the workmen and their directors.

The consumption of bichromate of potash is very large and of late years its price has been very steadily and uniformly maintained at $10\frac{1}{2}$ cents per lb., I am not prepared to say what is the consumption of this product in Canada but for the reasons above given, I do not think that the time has yet arrived to encourage its local manufacture.
