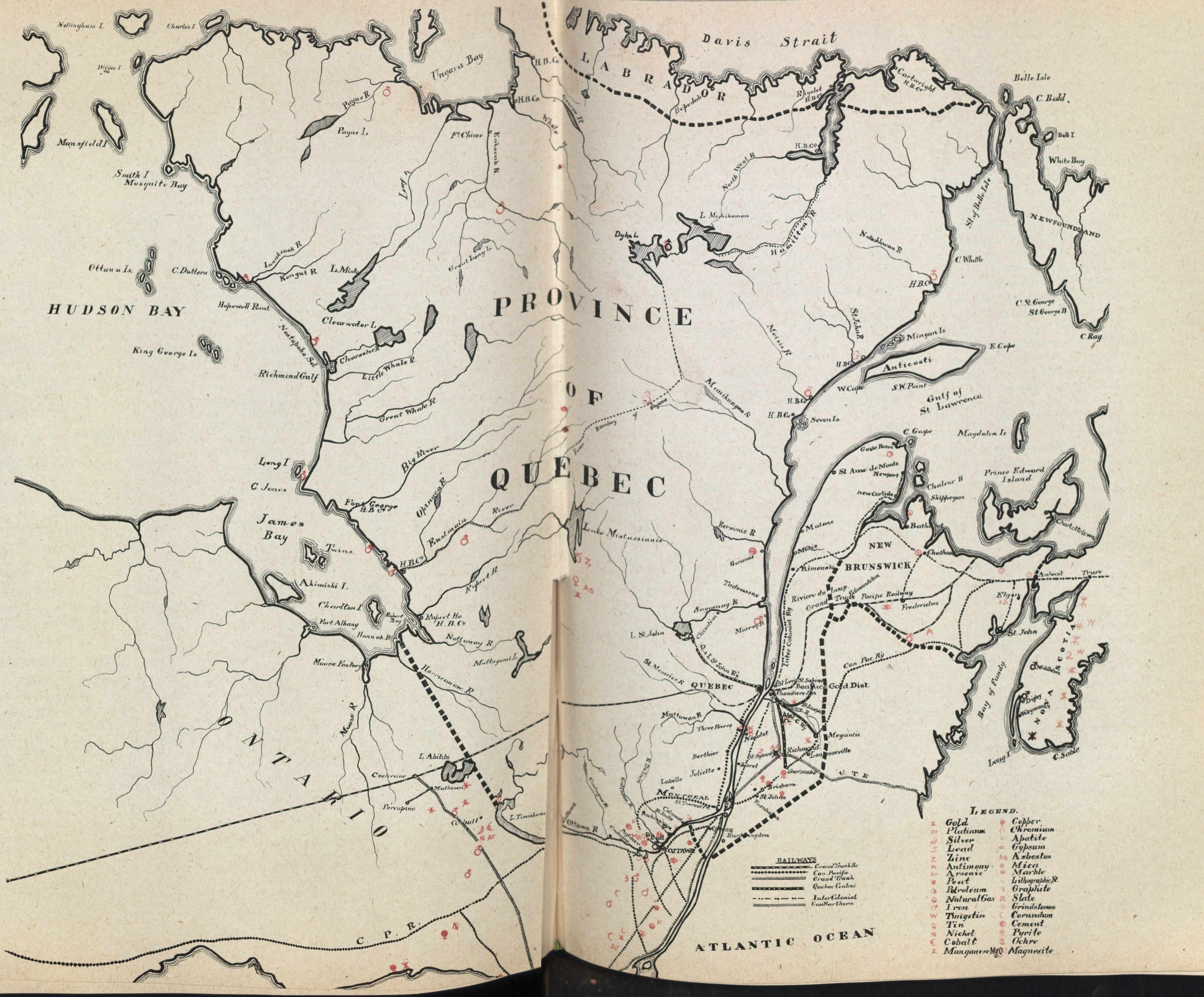
PROVINCE OF QUEBEC
HUDSON BAY
James Bay
Davis Strait
LABRADOR
Ungava Bay
NEWFOUNDLAND
Anticosti
Gulf of St Lawrence
Prince Edward Island
NEW BRUNSWICK
NOVA SCOTIA
ONTARIO
ATLANTIC OCEAN
QUEBEC
MONTREAL
OTTAWA
Lake Mistassinnis
L. Abitibi
Cobalt
Porcupine
Cochrane
Moose Factory
Fort Albany
Akimiski I.
Charlton I.
Rupert Ho H.B.Co
Fort George H.B.Co
Richmond Gulf
Hopewell Point
Long I
C. Jones
Mansfield I
Smith I Mosquito Bay
Ottawa Is.
King George Is
Great Whale R
Little Whale R
Big River
Eastmain River
Rupert R
Nottaway R
Harricanaw R
Moose R
Clearwater L
L. Minto
Payne R
Payne L.
Ft Chimo
Koksoak R
L. Michikamau
Dyke L
Hamilton R
North West R
Hopedale
Rigolet H.B.Co
Cartwright H.B.Co
Belle Isle
C. Bald
Bell I.
White Bay
St. of Belle Isle
C. St. George
St George B
C. Ray
Mingan Is
E. Cape
W. Cape
S.W. Point
Seven Is
Magdalen Is
C. Gaspe
Gaspe Basin
St Anne de Monts
Newport
Chaleur B
Shippegan
New Carlisle
Bathurst
Chatham
Charlottetown
Amherst
Truro
St. John
Fredericton
Bay of Fundy
Digby
C. Sable
Long I.
Matane
Rimouski
Riviere du Loup
Grand Trunk Pacific Railway
Inter Colonial Ry
Can. Pac. Ry.
Tadoussac
Saguenay R
Murray B.
L. St. John
Chicoutimi
Q. & L. St. John Ry
St. Maurice R
Bersimis R
Manikuagan R
Three Rivers
Nicolet
Richmond
Lennoxville
Sherbrooke
Megantic
Beauce Gold Dist.
Chaudiere Jn
Berthier
Joliette
Sorel
Labelle
St. John
Huntingdon
Ottawa R
L. Timiskaming
Matheson
C.P.R.
G.T.R.
RAILWAYS
Grand Trunk Ry.
Can. Pacific
Grand Trunk
Quebec Central
Inter Colonial
Can. Northern
LEGEND.
Gold
Platinum
Silver
Lead
Zinc
Antimony
Arsenic
Peat
Petroleum
Natural Gas
Iron
Tungstin
Tin
Nickel
Cobalt
Manganese
Copper
Chromium
Apatite
Gypsum
Asbestos
Mica
Marble
Lithographic St.
Graphite
Slate
Grindstones
Corundum
Cement
Pyrite
Ochre
Magnesite

THE CANADIAN MINING JOURNAL

VOL. XXXIII. TORONTO, July 1, 1912. No. 13

The Canadian Mining Journal

With which is incorporated the
"CANADIAN MINING REVIEW"
Devoted to Mining, Metallurgy and Allied Industries in Canada.

Published fortnightly by the

MINES PUBLISHING CO., LIMITED

Head Office - Room 36, Canadian Birkbeck Building, 10 Adelaide Street East, Toronto.
Branch Office - - - - - - - 34B Board of Trade Building
London Office - - - Walter R. Skinner, 11-12 Clement's Lane London, E.C.
U. S. A. Office - Ward & Smith, 931 Tribune Building, New York

Editor J. C. MURRAY. B.A., B.Sc.
Contributing Editor H. MORTIMER-LAMB

CIRCULATION.

"Entered as second-class matter April 23rd, 1908, at the post office at Buffalo, N.Y., under the Act of Congress of March 3rd, 1879."

CONTENTS.

QUEBEC.

In publishing this special Quebec issue of **The Canadian Mining Journal** we have kept in view two objects. The first of these has been to bring to the attention of our readers the many unique openings that the Province offers to the investor. Therefore, we have given prominence to such enterprises as the mining and preparation of China clay, the utilization of titaniferous iron ore, the markets for mica and graphite, and the quarrying of magnesite and marble. While, of course, the asbestos industry is not overlooked, it is not featured strongly, the field of asbestos mining has been thoroughly exploited. In fact it has suffered from over-exploitation. Hence, we have not attempted to do more than present a careful summary of the present position of the industry.

Our second object is to impress the public with the fact that Province of Quebec is entering upon a new phase in its mining history. No spectacular "booms" like those of Rossland, Cobalt, and Porcupine, ever blessed or cursed Quebec. It has, in truth, been quite overshadowed by its sister Province, Ontario. The arbitrary line of division between the two Provinces has also formed more or less of a barrier to the prospector. In other words, Quebec has not been the fashion. Nevetheless, the commercial mining opportunities in Quebec are unexcelled. One branch of mining may be taken as an instance. The Weedon copper mine, operated by a United States company, from small beginnings, has developed into a mine of large promise. The region in which the Weedon is situated has for years been known. Outcrops of copper-bearing iron pyrites were discovered long before the Weedon (or McDonald) mine was opened. Had this discovery been made in Ontario, in all probability there would have been scores of prospectors on the spot in a very short time. Since, however, Quebec was the scene of the discovery, no special activity resulted. Fortunately it was that a group of New York mining investors happened to be looking round for a mining chance.

A brighter aspect of the situation is presented when minerals other than copper ores are considered. Canadian investors are interesting themselves in China clay, in graphite, in mica, and in other mineral products. The commercial possibilities of these commodities have not been considered until now. With easy access to a cosmopolitan shipping port like Montreal there should be no difficulty in bringing these ventures to a profitable stage of development.

The extraordinary facilities available in the settled portions of Quebec, particularly in the Eastern Town-

ships, are themselves a large inducement to the miner. Throughout several counties hydro-electric power is obtainable at very moderate rates, and the prospecting chances are excellent. Labour is not expensive. Supplies can be readily obtained. Hence with the marked advantages such as good transportation, equitable laws, and accessible markets, there is every reason to think that Quebec is the "real tip."

We quite realize that it is impossible to give specific directions to the investor, yet it is quite within the bounds of editorial propriety to suggest certain lines of activity. And our suggestions can be made without the least element of invidiousness. We are convinced that the investor who knows his business sufficiently well to employ a properly qualified engineer, need take less chances in Quebec than in any other part of the continent. We say this advisedly.

By the same token this remark applies to Eastern Ontario, to portions of British Columbia, and to large areas of Nova Scotia. The success of one company means much to any community. It also has its bearing upon analogous ventures in other parts of the Dominion. The Weedon mine, as an example, may be looked upon as the keynote of the mining situation in the Eastern Townships.

Apart, however, from the purely commercial phases of mining, there is much to be learned about all countries. Quebec in a sense is terra incognito to the public. It is our privilege to publish the first authentic series of articles dealing with the mineral resources of the province. We hope and believe that the information collected for this issue of **The Canadian Mining Journal** will prove acceptable to our readers. This special number is one of several that we intend to publish during the current year. Each Province will be given all warranted publicity.

It is our good fortune to have friends upon whom we may call. Dr. James Douglas, the Hon. Mr. Devlin, Mr. Theo. Denis, Mr. J. Obalski, Mr. John E. Hardman, Mr. Fritz Cirkel, Mr. James Ross, and several others have contributed to these columns. To them our hearty thanks are due. Each has willingly done his utmost to assist us. If from all the other Provinces of Canada we receive the same whole-hearted support that Quebec has given us we shall be fortunate indeed.

It is a matter of sincere regret that space limitations prevent us from publishing several very timely articles that have been submitted to us. These articles will appear in later issues, and will, we hope, lose nothing in not being included in this number. Their non-appearance is altogether a question of printer's exigencies.

A BRIEF HISTORICAL SKETCH OF GOLD AND COPPER MINING IN QUEBEC

Written for the Canadian Mining Journal by Dr. James Douglas.

A historical sketch of Canadian mining should really begin with Jacques Cartier's mining for gold at Cap Rouge, and carrying back with him to France either some crystals of pyrites or flakes of mica, to be there disabused of the idea that all is gold that glitters. Talon, the great Intendant, sent Jolliette to confirm the Jesuit stories of native copper from the shores of Lake Superior. His enemies claimed that he was really promoting his friends' and his own dishonest traffic in furs under the guise of developing the national resources. How curiously history repeats itself!

The first real attempt to work the copper of Lake Superior was made at the instigation of the famous trapper, Henry. Unfortunately, Townsend, the Chancellor of the Exchequer, who framed the famous stamp act policy, lost money in the enterprise, and may thereby have been prejudiced against America, its people and its resources.

The only mining and smelting done under the French regime was on the bog ores of the St. Maurice. They continued to attract capital up to our own day. The story of their exploitation has been often and well told.

It was not until the close of the first half of the past century that there was any mining excitement in Canada. It was really started by the discovery of a nugget of gold on the Chaudiere River by a French girl, and the narration of her find by Captain Baddeley in Silliman's Journal. Some years elapsed, however, before any active gold washing was prosecuted on the tributaries of the Chaudiere. The greatest success was secured by a brother of Sir William Logan at the mouth of the Du Loup. The right to mine for gold was secured from Mr. De Lery, the seignior who had obtained a perpetual patent to mine for gold on his property, and transferred his rights to the Chaudiere Mining Co. It operated quite extensively, but unprofitably, on the gravels of the River Gilbert, or Tuffe de Pina. Subsequently the rights were secured by my father, Dr. James Douglas, but all work done was under license by the habitants themselves, and particularly on the gravels from the bed of the Des Plantes stream. All these streams flowed into the Chaudiere from the west. The present hydraulic gravel washing on a large scale is on the River DesMeulles, which flows into the Chaudiere from the east. The banks of the Gilbert and the Des Plantes above usual water level were known to be aurieferous in the early days, and in places the gravels were rich enough to be worked by the Long Tom and the cradle; but the quantity of gravel available was not at that time deemed great enough to warrant the introduction of hydraulicing on the California model.

The great quartz veins which are exposed at the Devil's Rapids in the Seignory of St. Francois, and at the falls above the junction of the Chaudiere and the Du Loup, offered a tempting inducement to engage in quartz mining; but, although gold bearing, the average

value everywhere of the quartz veins was so low as to be prohibitory. The only mass of quartz with gold in paying quantities was one my father paid a reward to Pere Paulin of $500 for finding. It was an ingeniously manufactured sample.

But copper mining in the Province of Quebec soon over-shadowed the interest in gold mining. Attention was first drawn to the copper deposits by Sir William Logan in his report for 1847-48, as Director of the Canadian Geological Survey. The first active operations were almost immediately afterwards commenced in the township of Inverness, but the adjacent township of Leeds was the scene of the most active efforts to mine the small gash veins and the large beds of low grade ore in the slates of the Quebec group. The history of the three or four companies that have succeeded one another in attempting vainly to extract money out of the Harvey Hill deposits is not an encouraging inducement to a fifth company to undertake such a forlorn task. Yet at the same time, now that there is railroad connection with the mine, and ores of as low grade, though in more favourable rocks, for mining, are being profitably exploited in the West, with very high labour cost, it is possible that money might be made where money formerly was lost. The operations at Harvey Hill, under the English and Canadian Mining Co., were sufficiently attractive to induce almost innumerable other mines being opened, principally on smaller deposits in the Quebec Group of rocks. Dr. A. W. J. Wilson, in 1909, spoke of his being recently commissioned to examine 525 places in the Province in which some of the minerals carrying copper have been found at some time or other. During the same early days a famous mine at Acton was opened on limestone, probably of Cambrian age. It was an extremely rich mass of what to-day we would call secondary ores, which cropped out at surface, and was for a time very productive and very profitable, according to the standards of those days. The rich ores being exhausted, work was abandoned, but with the knowledge we now have of copper in limestones and shales in some of the Arizona copper districts, the rocks carrying this mysterious and once famous deposit should be carefully studied.

The only mine still working of these hundreds of failures is the sulphur-bearing Eustice mine near Sherbrooke. It was opened under a different name in those early days, where there were three companies operating on these sulphur deposits. The two mines most energetically worked were—one owned by the Hon. George Drummond, and the other by a Hartford company. At that time the ores were roasted in heaps and matted in small brick furnaces, whose life was about a week or ten days; and if a furnace could put through ten tons a day, it was looked on as a phenomenon. The general manager of the Hartford, however, appreciated the necessity of utilizing the sulphur, and small acid works were erected at St. Joseph, opposite Quebec, and acid there first made out of the Capelton ores and the residues leaded for copper. There was, however, no market for the acid, and this progressive action in the right direction failed, like so many others, because premature—a negative lesson in conservation.

MICA MINING IN THE PROVINCE OF QUEBEC*

Hugh. S. de Schmid, M. E.

The majority of the mica mines operated in Quebec Province (as also in other parts of Canada), are concerned with the extraction of phlogopite or amber mica. Few muscovite or white mica mines have ever been worked in Canada, and such have, as a rule, also produced feldspar as a by-product.

Muscovite.

The muscovite-bearing pegmatite dykes are found cutting (as a general rule conformably) normal gneiss at localities as far apart as the coast of Labrador and the Yellow Head Pass in the Rocky Mountains. Scarcely more than a dozen muscovite mines have ever been operated in Canada, and of these the two largest are located in the eastern portion of the Quebec amber mica area, in the townships of Buckingham and Villeneuve, in Ottawa county. They are now both owned by O'Brien & Fowler, of Ottawa. The general occurrence of muscovite is, in the main, similar in all parts of the world; that is to say, the mineral is always found in pegmatite, or coarse, granitic dykes, the mass of which is composed of feldspar and quartz in varying proportions, and in which the mica crystals occur disseminated. Mining at the above-mentioned localities has been carried on in an intermittent fashion since the early eighties, and considerable quantities of mica, feldspar, and quartz have been shipped.

Pegmatite dykes have almost always well-defined contact with the enclosing country rock, and the mica not infrequently occurs in greatest quantity along or adjacent to such contact, affording a ready indication as to the direction to be followed in mining.

All the muscovite mines in this Province are operated openwork in the readiest and simplest manner. An open cut is driven into the side of the hill traversed by the mica-bearing dyke, and as a rule adjacent to one or other of its contacts with the enclosing gneiss; or, if the deposit is located on the summit of a ridge or hill, the contact is excavated by a series of pits at intervals along it. The mining of such deposits calls for only ordinary methods, such as would be employed in quarrying—the mines being, in effect, open quarries. The following of the mica crystals presents the main difficulty and for this there is no rule, the locating of sufficient mineral to pay expenses being purely a matter of chance. It is almost always necessary, in extracting a relatively small amount of mica, to break a very large quantity of ground, and the removal of this waste constitutes one of the principal drawbacks to mining. Where the feldspar and quartz enclosing the mica crystals occur in a sufficiently pure and non-intergrown state, both these minerals can sometimes be saved as by-products—the feldspar to be used for the manufacture of porcelain and the quartz in electric smelting, the manufacture of ferro-silicon, etc. The feldspar thus saved at the Quebec muscovite mines is shipped to the potteries at Trenton, N. J., and the quartz to Welland, Ont. In addition to the quality of spar sufficient for the porcelain industry, there occurs at the Villeneuve mine a very pure microline feldspar, which is

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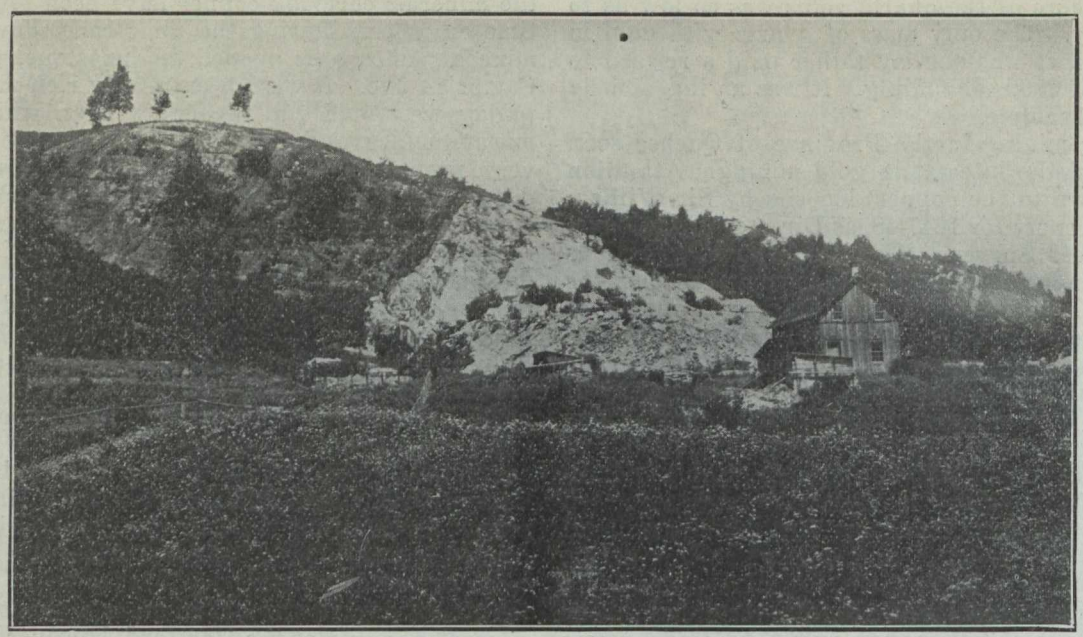


Villeneuve Mica Mine

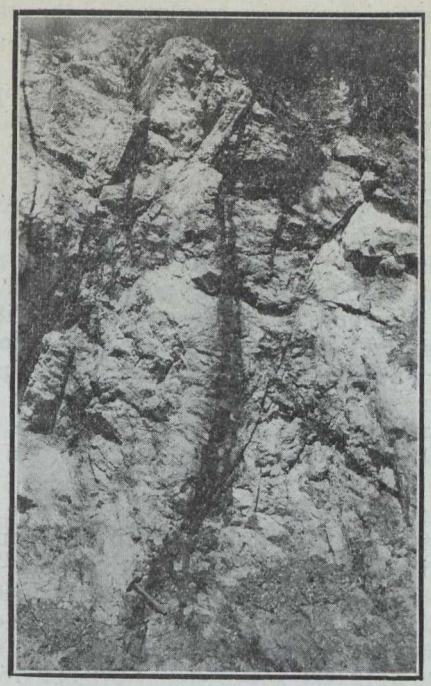
largely used in the manufacture of artificial teeth, and for this purpose brings a high price. There is no machinery used at present at the mines mentioned.

Phlogopite.

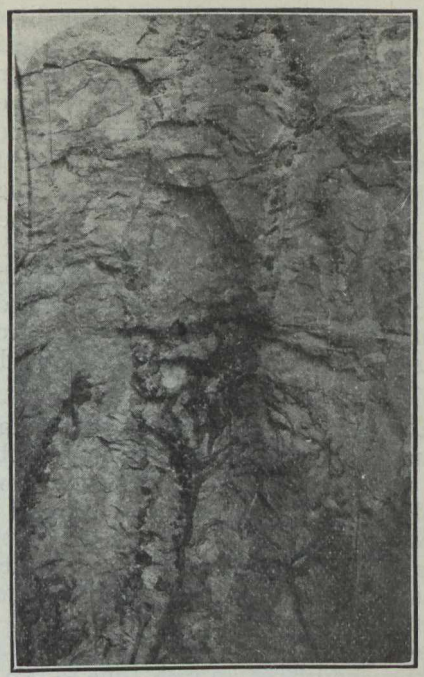
Mining (if such a term can be applied to many of the operations carried out in search of this mineral) for amber-mica provides occupation for all and sundry throughout the area traversed by the mica-bearing pyroxenite belts. In the 'between-seasons' farmers frequently forsake their usual employment and blow holes in the rocks at what they consider 'likely' spots—bringing to light smaller or larger quantities of mica as the case may be. The occurrence of amber mica throughout the district lyng between and along the Liivre and Gatineau Rivers, immediately north of Ottawa, is so general that the possibility of its existing in greater or lesser amount on almost any lot cannot be said to be precluded. Mining is carried on principally by small operators, many of whom lease the property they work, and who are seldom possessed of the desire or the means to carry out any active mining.

As a result, the surface of the hills in this region is pitted with small prospect holes, ranging from five to twenty feet in depth, which have been excavated on pockets of mica, and abondoned as soon as the output of mineral became less than the outlay of capital. It must be stated that the occurrence of amber mica is usually totally and entirely against any regular methods of mining and frequently effectually disappoints the most sanguine operator. There are no rules which can be laid down or followed in the search for the mineral, and the forceful factor of chance has to be relied upon in the generality of instances. This accounts, no doubt, for the abundant evidence of unsuccesful expenditure of both enegry and money which is to be met with all over the area mentioned. The mineral occurs both in pockets of very irregular shape and extent, an also in more or less well-defined 'leads' which sometimes join up a series of such pockets. These two modes of occurence are the most general. Instances are also found in which the mica crystals are disseminated in a mass of calcite between well-defined walls, the deposit having much of the character and appearance of a true fissure-vein. This class of deposit is easy to follow and to exploit in comparison with the more usual pocketty type, but the amount of mica present in the vein-filling is so variable, and (still more important) the quality of the mineral so subject to deterioration, by reason of crushing and distortion of the crystals, caused by natural pressure in situ, inclusions of foreign mineral substance, a tendency to ribbon-structure (the sheets dividing into narrow strips), brittleness due, often, to the local presence of iron in the deposits, that, in this case also, mining frequently has to be abandoned. A somewhat similar class of deposit is that known as a 'contact', where the mineral occurs in a body of calcite between pyroxene and either crystalline limestone or an acid rock —usually granite gneiss. These two last types are, however, sufficiently alike in their main features to call for a similar method of development, and present few of the difficulties which the pocketty deposits so often place in the way of the operator. Such mica bodies are mined in the manner usually employed in lode-mining, the calcite filling being stoped out in a precisely similar fashion, and the mica crystals collected from the waste rock in the pit as the work proceeds. Some of the deepest mines in the mica district have been opened on either contact or

Mass of Apatite from Blackburn Mica Mine



Muscovite—Mica-bearisg Pegmatite, Cut by Narrow Vein of Trap—Villeneuve Mine



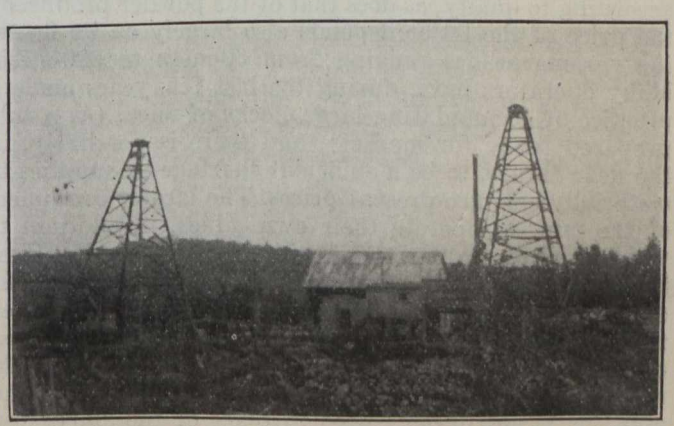
Vein of Amber Mica at Moose Lake Mine

vein deposits. The irregular nature of the pockets and the frequent impersistence of the fissures which sometimes connect them prove serious obstacles in the abovementioned 'pocket and fissure' class of deposit; and since the majority of deposits are of this type, it is not surprising that so many abandoned pits are to be met with. Many operators have no doubt derived handsome profits from working small surface pockets of mica, for, provided the mineral be of good quality and size, a relatively small pocket will yield a surprising amount of mica, and thousands of dollars worth of marketable sheets are sometimes the result of only a few weeks' work. Such cases are, however, the exception, and the number of small operators who have attempted the exploitation of such deposits and made a success of their venture, is small. Those mica bodies of the vein or contact type, which have been uncovered by small miners, have, as soon as their nature became evident, as a general rule passed into the hands of large syndicates, who continued their development with the aid of machinery and deep shafts—relatively deep shafts, that is, for the deepest excavation in the district, made in following a mica body, probably does not exceed two hundred feet.

Many of the mica mines worked at present, and during the past thirty years or so, have developed from what were originally phosphate pits, and even now, at many points, the two minerals are won simultaneously, though the small price (about $11.00 per ton delivered) offered for the latter mineral, and the limited demand for it, do not encourage operators to pay particular attention to saving it, except where very large bodies are met with. The entire production of phosphate derived from the Quebec mica mines is consumed at Buckingham, Que., where it is utilized in the manufacture of fertilizer and phosphorus. When the writer made an inspection of the mica-mining area in 1911, there were not above five and twenty mica properties in active operation, and few of these employed more than some half a dozen men. Steam is used at the larger mines, both for drilling and hoisting, and also, in some cases, to run a small pump; the last is, however, seldom necessary, the pits being for the most part shallow and often possessing natural drainage.

Derricks are the general means used for hoisting; either open wooden hoist-trays or iron or wooden buckets being employed to contain the rock, etc. The derricks are operated by small steam winches, or, in the case of

Inclined Vein of Amber Mica in O'Brien and Fowler Mine, Range III, Township of East Portland, Que.



Hoist Towers at Blackburn Mine, Templeton, P.Q.

the smaller mines, by horse power—either direct traction or with the help of a large wooden drum or whim. Drilling is usually done by steam in the case of a mine whose value has been demonstrated, (in so far as this can be said to be possible in the case of a mica mine), Rand drills being the most commonly used. At many of the smaller mines, however, double-handed hand-drilling is practised. The holes are, as a rule, shallow, and are only lightly loaded, (except where the object is to remove dead rock) being so placed as to loosen the rock rather than to shatter it. These methods are essential in order to preserve the mica crystals as far as possible from injury. Dynamite is the explosive generally used, and both fuse and battery firing are employed.

The mica crystals are collected as soon as ground has been broken and are transferred to the cobbing-shed, where they are roughly sorted and freed from adhering rock, phosphate, etc. From here they proceed to the culling-shed (commonly called "mica-shop"), and here the crystals are split into sheets of some one-sixteenth of an inch thickness. The rough edges are trimmed off, and the clean plates are then packed into barrels and shipped to the factories, where they are thin-split into flakes of one to two one-thousandths of an inch (one to two mile,) and manufactured, with the aid of shellac or some similar preparation, into mica-board or micanite. The more solid and perfect sheets, which are free from creases, inclusions, and other imperfections, and exceed 2x3 inches across, are cut into rectangular pieces of the dimensions required by the consumers and are employed without any further treatment in dynamos and other electrical machinery. Girls are usually employed in the culling-shops, and also in the thin-splitting department of the factories, and are generally paid by the weight of the splittings they produce. Scrap mica, composed chiefly of the refuse from the culling-sheds and splitting-shop, is utilized for the manufacture of ground or pulverized mica, which is used for giving a finish to wall-paper, in refractory paints, in rubberoid roofing material, and even as an absorbent for nitro-glycerine in the manufacture of dynamite. There are three grinding plants in Canada at present engaged in the preparation of mica powder—all three being operated in conjunction with factories concerned in the manufacture of mica-plate. The refuse mica from the mines is not so fitted for this process owing to the amount of foreign matter often present in it, but with careful screening or cobbing could be similarly utilized. Large quantities of such mine refuse exist at the various mines and would be available should a demand spring up. The price of scrap mica for grinding varies very much according to qualty, as does that of the powder produced; the price of the latter depends also largely on its finess, the various grades ranging from 60-mesh to 200-mesh. Many operators have, during the last few years made a practice of accumulating large stocks of mica, (as a rule prepared ready for market), and there is not likely, in the near future, to be a sufficient shortage of supplies to materially enhance present prices. The largest consumers of the mineral operate their own mines, in addition to which the buy up parcels of mica from the small mines; but as the former appear to possess, in most cases, sufficient reserves of the mineral upon their own properties, they can usually buy at their own prices. The chief effect of this policy of hording mica is to increase the demand for foreign (either American or Indian) mineral, and this is now largely used in place of the amber variety, despite the fact that it is slightly harder and not or such high quality as the latter.

The amount of sheet mica employed in the stove industry would appear to be steadily decreasing, though lamp chimneys and shields still consume a quantity. Only the clearest sheets of muscovite or white-mica are suitable for these purposes, and the supply is derived entirely from foreign countries.

The grading of the mica intended for foreign shipment would appear (from advice received from one of the largest English consumers), to leave much to be desired, and is largely responsible for the poor reputation consignments of Canadian mica possess in foreign markets. There is no question of the superior quality of Canadian phlogopite for the purpose (electrical) for which it is required; but would-be buyers claim that shipments are not uniform, and are, above all, seldom up to sample standard, large quantities of absolutely useless, crumpled and ragged, mica being often included to make up weight.

These tactics can only serve to injure the Canadian mica industry, (and have, in fact, already done it much harm), while improving that of other mica-producing countries. The total value of the mica produced in Quebec in 1911 was $76,433, while the total value of production for the whole of Canada during the same year amounted to $119,863, a decrease of $70,522 over the previous year's output. The figures of production are compiled from returns furnished by producers, and are often misleading, owing to the practice pursued by operators of accumulating stocks of mica—the returns of production usually referring to the quantity actually sold in the year in question, irrespective of when it was mined. Thus, a quantity of mineral may sometimes figure in the production returns of a year long subsequent to the closing down of the mine from which it was obtained. In another case, record of a production so sold may be entirely overlooked, the amount not figuring in the returns of any year. The current prices of amber-mica are approximately as follows, the figures being furnished by a large Ottawa firm:

1 in. x 1 in. 4 cents.	2 in. x 4 in. 60 cents
1 in. x 2 in. 10 cents.	3 in. x 5 in. 75 cents
1 in. x 3 in. 18 cents.	4 in x 6 in. 90 cents
2 in. x 3 in. 40 cents.	5 in. x 8 in. over $1.25

ZINC AND LEAD IN QUEBEC.

The only lead-zinc deposits mined in the Province are those of Calumet Island. These have been worked intermittently since the early "nineties," but in the last two years operations appear to have been more systematically conducted, and in 1911 development work on a relatively large scale was undertaken. Calumet Island is situated about fifty miles up stream from Ottawa, and is formed by two channels of the Ottawa River. The rocks here are the typical Laurentian gneisses and crystalline limestone, with basic intrusions. The ore deposit may perhaps be best described as Fahlbands. They doubtless can be profitably mined under skilled direction.

Another galena occurrence—a prospect only—near Notre Dame des Anges, Portneuf County, is now being developed.

PHOSPHATE IN QUEBEC.

The production of phosphate was at one period the principal mining industry of the province. The industry dates from 1871, when a few tons were mined near the Little Rapids, on the Lièvre River. Thenceforward production increased rapidly, reaching the maximum in 1885, represented by an output of 28,535 tons

valued at $490,331. For a time thereafter the industry held its own, but gradually declining, was practically non-existent in 1895. Meanwhile there appears a likelihood of a revival of interest; indeed, of late negotiations have been in progress for the acquisition of properties near Buckingham. The time is not far distant when there will be a large home demand for artificial fertilizers. This demand will increase steadily. With a home market for the product the phosphate industry would again be an important one. As is well known, the decline of the Quebec industry was directly due to the discovery of extensive phosphate deposits in Florida and Tennessee, and the conditions were such to enable these deposits to be worked and the product marketed abroad more economically than was possible in our own industry. The Quebec phosphates occur as apatite in masses and dykes of pyroxenites, cutting the Laurentian gneisses of the region to the north of the Ottawa River.

The production in 1911, by the way, was 595 tons, valued at $5,832.

PERSONAL AND GENERAL

Mr. John L. Retallack, of Kaslo, British Columbia, has returned to that province from a visit to England.

Mr. A. W. Davis, one of the mining engineers on the staff of the Consolidated Mining and Smelting Company of Canada, Ltd., has been examining mineral claims near Hazelton, Skeena district, B.C.

Mr. S. S. Fowler, general manager of the New Canadian Metal Company, operating the Blue Bell lead-silver mine on Kootenay Lake, B.C., was in Victoria lately.

Mr. C. H. Clapp, of the Geological Survey, has resumed his geological work on Vancouver Island, in which part of British Columbia he has been engaged each field season from 1908, inclusive.

Mr. Colin Timmons, mining engineer, until recently of Taxco, Guerrero, Mexico, arrived at Hedley, Similkameen, B.C., from Los Angeles, California, on June 4, to examine the Kingston mining property for San Francisco clients.

Mr. J. M. Gordon has been examining mineral claims near Rossland, and others in Ymir district, B.C., for a Montreal company, stated to also own coal lands in southwestern Alberta.

Mr. W. Hutchison, for some time at the Hillcrest Coal and Coke Company's colliery, near Frank, Alba., lately removed from that part of the province to a coal mine farther north.

The Hon. Richard McBride, Premier and Minister of Mines for British Columbia, has been knighted. He is now Sir Richard McBride, K.C.M.G.

Mr. A. B. Ritchie, a McGill 1906 graduate in mining engineering, lately left New Denver, British Columbia, for Montreal, after having spent several years out West.

Mr. A. J. McMillan, liquidator of the Le Roi Mining Company, Ltd., will shortly return to British Columbia from England. A short time ago he made a further distribution of one shilling a share among Le Roi shareholders.

Mr. H. A. Brandt has been appointed superintendent of the British Columbia Copper Company's Lone Star and Washington mine, which is situated immediately south of the International Boundary and within ten miles of the company's smeltery at Greenwood, B.C.

Mr. John Gibson, Jun., has retired from the position of superintendent of the Union colliery of the Canadian Collieries (Dunsmuir), Limited, in Comox district, Vancouver Island. Mr. Gibson was from Pittsburg, Pa.; he had also been two years in Spitzbergen.

Mr. J. Edgar McAllister, of New York, consulting engineer to the British Columbia Copper Company, has recently been on one of his periodical visits to that company's properties in British Columbia.

There have been some changes made at the Union colliery of the Canadian Collieries (Dunsmuir), Ltd., Vancouver Island, B.C. The several mine managers there now are: Mr. Robert Henderson, in charge of No. 4 mine; Mr. J. H. McMillan, of Nos. 5 and 6, and Mr. Thomas A. Spruston, of No. 7.

Mr. John Hopp, well-known in connection with his extensive placer gold mining operations near Barkersville, Cariboo district, B.C., was ill at his home in Seattle, Washington last month. About two years ago he suffered during several months from ptomaine poisoning, and it is thought likely his late sickness was a return of the old trouble, the effects of which he had occasionally felt since convalescence after his earlier serious illness.

Mr. Geo. Watkin Evans, of Seattle, Washington, who recently resigned as Chief of Coal Surveys for the Washington State Geological Survey, has gone to the anthracite field at the headwaters of Skeena River, British Columbia, to examine and report on coal lands in that district held by the National Finance Company, of Vancouver, B.C.

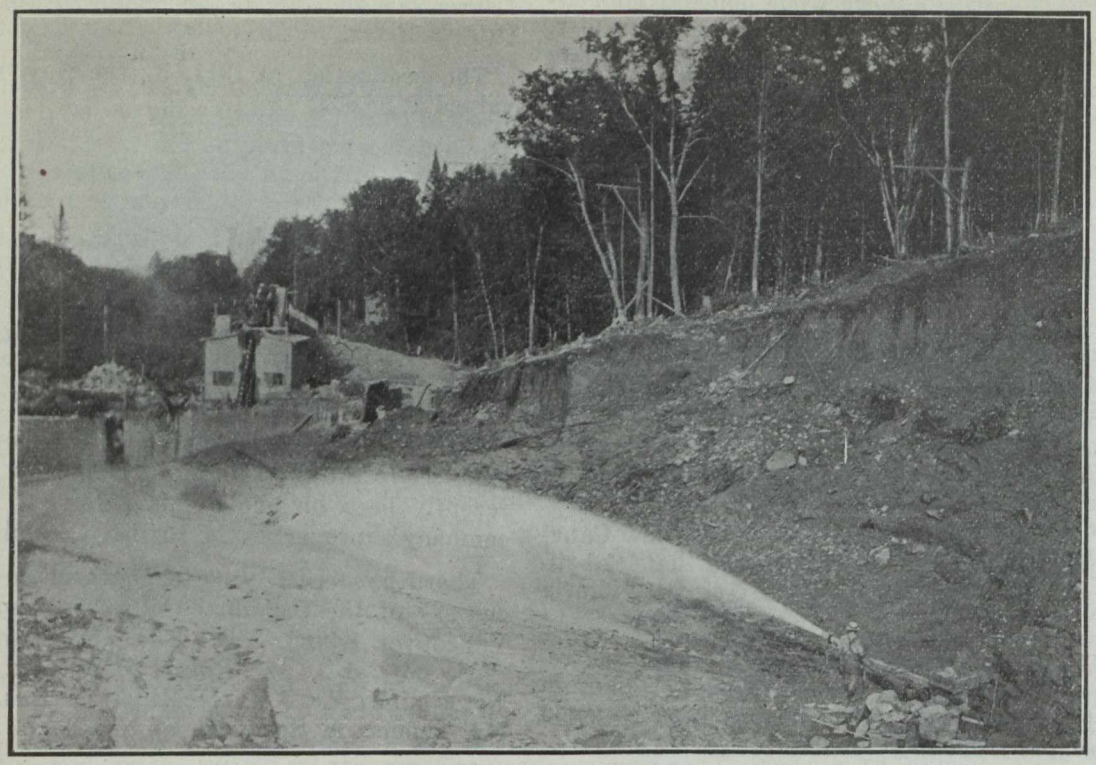
Mr. Thomas Graham, chief inspector of mines for British Columbia, left Victoria on June 12 for Columbus, Ohio, to attend the fourth annual convention of the Institute of Mine Inspectors. Before returning to British Columbia, Mr. Graham will visit the United States Bureau of Mines' testing station at Pittsburg, Pennsylvania, and afterward endeavour to see some representative coal mines in the State of Illinois.

Mr. James McEvoy, of Toronto, was in Vancouver, B.C. early in June, outfitting a party to do further development work on the coal property of the Western Development Company, situated in the Groundhog basin coalfield, upper Skeena district of British Columbia, which district Mr. G. S. Malloch, of the Geological Survey, examined in a preliminary way last autumn, and will investigate to a larger extent this year.

GOLD AND SILVER IN QUEBEC.

Mining for gold in the Province is at present confined to the hydraulic operations of the Champs d'Or de Rigand-Vaudreuil (formerly the Dominion Gold Fields, Ltd.), in Beauce County, and to development working by the Union-Abitibi Company, on a quartz claim north of Lake Opazatica. Here a shaft has been sunk to a depth of rather over 150 feet, and drifts carried therefrom at intervals. From the amount of work done the claim has clearly not yet passed the prospect stage. Yet a power plant and stamp mill has been provided in readiness for the treatment of the ore—when it materializes.

Late last autumn some excitement was occasioned by reported gold finds in Risborough Township. The discoveries in two localities were investigated by Mr. T. C. Denis, the Superintendent of Mines, who reports that the quartz deposits occur in the slates, which constitute the country rock, near the contact with diabasic intrusions in one case and apparently porphyrites in the other. Some of the quartz veins are from 10 to 20 inches wide, and in the immediate vicinity of the larger veins the rock shows a network of smaller quartz veins. Values, however, were practically negligible. The silver now produced in Quebec is recovered from the cupriferous pyrite ores of the Eastern Townships. There is also a small yield of gold from this source.



Beauce Hydraulic Co.

ONTARIO MINES—FIRST QUARTER OF 1912.

Returns to the Bureau of Mines for the first three months of 1912 show the output of the metalliferous mines and works of Ontario to have been as follows:—

Product.	Quantity.	Value.
Gold, ounces	573	10,266
Silver, ounces	7,439,044	4,092,405
Copper, tons.	2,537	360,799
Nickel, tons	4,722	1,009,702
Pig Iron, tons	116,824	1,858,274
Cobalt and Nickel Oxides, Crude Cobalt material, etc., lbs.	538,170	100,365

Silver—Compared with the first three months of 1911, silver production showed an increase in value of $383,861, though the quantity was less by 91,443 ounces. Cobalt proper produced 7,006,842 ounces, South Lorrain 285,042 ounces and Gowganda 147,103 ounces. Shipments were:—Ore 4,346 tons, concentrates 2,528 tons, bullion 1,445,834 ounces. Of the total quantity of silver 4,197,161 ounces were obtained from ore and concentrates treated in Ontario plants. Adding bullion shipped by the mines themselves, over 75 per cent. of the total yield of silver was recovered in Ontario.

Gold—A decerase of $13,274. In the early part of 1911 the experimental stamp mills at Porcupine were at work. Later in the year they were destroyed by fire, and at neither the Dome nor the Hollinger had the new plants begun to produce during the first quarter of 1912. As a consequence, Porcupine's contribution to the gold output was small.

Nickel—An increase in quantity of 598 tons and in value of $124,710.

Copper—The output is greater by 416 tons in quantity and $57,559 in value.

..Pig Iron—An increase of 1,370 tons in quantity and $34,557 in value.

Iron Ore—In the first quarter of 1911 shipments amounted to 11,621 tons; no shipments were reported during the corresponding period in 1912.

..Cobalt Material—Practically all the Cobalt oxide now used comes from the mines of Cobalt district. Production has for the time being ceased in New Caledonia, whence large quantities of Cobalt ore were formerly exported to Europe.

THE PROVINCIAL MINES BRANCH AND THE MINERAL RESOURCES OF QUEBEC

By the Hon. C. R. Devlin, Minister of Mines.

The mineral resources of a country should be regarded as a source of national wealth, and, as such, it is a Government's duty to do all in its power to encourage and foster their rational development and exploitation.

The Government can be a factor in several ways in the achievement of this object: 1st, by its mining laws; 2nd, by diffusing knowledge concerning possibilities of our mineral resources; 3rd, by explorations in the field in charge of unbiassed and able investigators; 4th, by the publication of reliable statistics and information for the guidance of investors.

The Quebec Government wishes primordially to encourage and protect the bona-fide prospector, for it is on his arduous pioneering work that depends the discovery of mining regions now unknown. The Quebec mining law is liberal toward him, and the conditions which he has to fulfill to hold mineral claims are not at all onerous, while the compulsory assessment work required is a guarantee against "blanketting."

In respect to mining laws, those best fitted to judge of their efficiency must necessarily be the men who are directly interested in mining. It may be pointed out that the mining community has been consulted, through the Canadian Mining Institute, through enquiries from prospectors, through operators of mines, in the framing of our present Quebec laws, and the Government intends to freely avail itself of these means to change or further improve our mining regulations as needs arise.

It is interesting to note that the United States Government is at present considering the revision of their mining law, and, in this connection, Dr. George Otis Smith, Director of the Geological Survey, after a careful study of the matter, advises the following principles as being fundamentally essential to efficient mining laws: 1st, separation of the mining rights from the surface rights; 2nd, a leasehold system in preference to a fee simple tenure; 3rd, rigid enforcement of annual assessment work.

The Quebec mining laws are practically based on these three principles.

Field investigations in mining districts are regularly carried out by the Quebec Mines Branch. This does not imply that the Government should carry on prospecting with the view of discovering metalliferous veins or other mineral deposits, but it is one of the important duties of a Department of Mines to obtain accurate and unbiased information on the mineral resources of certain regions and to work out the geology, as a guide to the prospector, the miner and the investor. Following this principle, the Quebec Mines Branch has, in the course of the last two years, organized and sent out geological parties to the Chibougamau region; in the Temiskaming district; in Abitibi; on the north shore of the lower St. Lawrence. Reports have been published or are at present in press. This work will be actively pushed in the future.

Our mining laws provide for the imposition of a royalty on minerals extracted. These regulations have not yet been enforced, but it is only fair that the Government should derive some slight revenue from well-established and remunerative industries which are based on mining concessions and mining rights obtained from the Crown at practically nominal figures, as compared with the value of mining properties under exploitation, and the collection of such a tax would in no way militate against the welfare of the mining industry.

The Quebec mining industry is comparatively young, but our Province is rich in mineral possibilities. The railways under construction and those which are projected will open up immense territories fraught with mining possibilities, which will be heard from as soon as means of access are accomplished facts, and the development of our mineral resources has a bright future before it.

RAILWAYS AND THE MINERAL INDUSTRY.

In the near future railway communication will be established between Quebec City and Lake Abitibi, by the completion of this section of the National Transcontinental. Again, the construction of a line bordering the Quebec side of Lake Temiskaming, to afford communication between the settlements of Northern Temiskaming and the main line of the Canadian Pacific Railway, is practically assured. The extension of this line northward to connect with the Transcontinental is also probable. Still another railway is projected from the Nottaway, or James Bay, to provide communication with Montreal. From the main lines numerous branch lines or feeders will be established in due course. This programme of railway building is based on the expectation of returns from the development of the agricultural and forest resources of the regions to be traversed; but doubtless a very considerable revenue will also be derived from new mining industries. This, at least, has been the experience in this country in the past. Thus the Quebec Central, between Sherbrooke and Quebec, was built to advantage along the rich agricultural valleys of the Chaudière and St. Francis Rivers; but at present the asbestos mines of Thetford and Black Lake, which were discovered as a consequence of railway construction, are the main freight contributors to the railway. In Ontario, the Timiskamingue and Northern Ontario Railway was built to colonize that part of the Province to the north of the Canadian Pacific Railway. The mines of Cobalt, which were discovered during construction, and the mining district of Porcupine, are now by far the main sources of revenue of this railway. While, as is well known, the nickel-copper mines of Sudbury were discovered during the construction of the main line of the Canadian Pacific Railway. Consequently, although it would be unwise to build railways on the revenue possibilities of the undeveloped mineral resources of a region alone, yet in Ontario and Quebec the conditions are such that important mining development may usually be expected to follow the opening of new territory by railway construction; and the industry thus established invariably contributes in a large measure to the railway traffic receipts.

PROGRESS OF THE MINING INDUSTRY IN QUEBEC

Although no very notable new mineral discoveries have been made in the Province of Quebec in recent years, the industry has made continuous and steady progress from year to year since 1903, as evidenced in the following table:

Year.	Value.
1903	$2,772,762
1904	3,023,568
1905	3,750,300
1906	5,019,932
1907	5,391,368
1908	5,458,998
1909	5,552,062
1910	7,323,281
1911	8,677,986

In 1899 the value of the mineral production was $2,083,272. The returns for 1911 represent, therefore, an increase in twelve years of 316 per cent. This showing, it is interesting to note, compares most favourably with that of the other Provinces of the Dominion in respect of mining development, as will be observed from the figures appearing in the following table, compiled from statistics published by the Federal Department of Mines:

Mineral Production of Canada, by Provinces, 1899 and 1911.

	1899.	1911.	Increase in 12 years.
Canada	$49,234,005	$102,291,696	107.7%
Ontario	9,819,557	42,672,904	334.5%
British Columbia	12,653,860	21,237,801	67.9%
Nova Scotia	6,996,041	15,354,928	119.5%
Quebec	2,585,635	9,087,698	251.5%

Thus the only Provinces whose mineral industry has made greater progress than that of Quebec during the period here considered is Ontario, whose advantage in this respect is, directly, attributable to the discovery and development of the Cobalt silver mines. In northern, and more particularly in northwestern Quebec, are large areas, the geological conditions of which are apparently very similar to those obtaining at Cobalt, Porcupine and Sudbury; and there is every reason to hope, therefore, that important new discoveries of mineral will be made in these practically unexplored areas.

The following table includes a statement of the mineral production of the Province in 1911, as finally revised; while also showing the number of men employed in the industry and their earnings during the twelve months:

	Number of Workmen.	Wages.	Quantities.	Value.	Value in 1910.
Asbestos, tons	2,911	$1,228,971	102,224	$3,026,306	$2,667,829
Asbestic, tons	...	.....	25,733	19,802	17,612
Copper and sulphur ore, tons	178	100,130	38,554	240,097	145,165
Gold, oz.	...	.....	590	11,800	.....
Silver, oz.	...	.....	23,000	11,500	.....
Bog iron ore, tons	48	6,400	931	4,041	4,406
Ochres, tons	50	15,518	3,612	28,174	33,185
Chromite, tons	13	3,085	197	2,469	3,734
Mica, lbs.	186	48,101	.....	76,428	51,901
Phosphate, tons	5	.....	595	5,832	3,182
Graphite, lbs.	274	64,535	753,405	33,613	15,896
Mineral waters, gals.	36	5,645	168,489	65,648	68,155
Titaniferous ores, tons	26	724	3,789	5,684	5,292
Slate	25	7,522	.....	8,248	18,492
Cement, bbls.	627	443,842	1,588,283	1,931,183	1,954,646
Magnesite, tons	8	3,194	885	6,416	2,160
Marble	170	105,739	.....	143,457	151,103
Flagstone, squares	2	500	6	500	890
Granite	423	239,704	.....	308,545	291,240
Lime, bushels	226	118,171	1,284,914	284,334	279,306
Limestone	1,255	569,818	.....	1,128,402	503,173
Bricks, M.	1,280	362,663	176,532	1,129,480	906,375
Tiles, drain and sewer pipe, pottery, etc.	21	3,922	.....	142,223	197,526
Quartz, tons	...	.....	500	1,125	2,013
Feldspar, tons	...	.....	30	600	.....
Peat, tons	12	3,000	175	700	.....
Glass sand	2	413	440	1,179	.....
Sand	68	34,206	.....	62,000	.....
Totals	7,846	$3,365,803	4,172,884	$8,679,786	$7,323,281

MINING LAWS IN THE PROVINCE OF QUEBEC

No change or amendments were introduced in the Quebec Mining Law during the last session of the Provincial Legislature; but in the last three years, the mining laws have undergone such radical alterations, that it is permissible to give a short résumé of the principles now in force.

The amendments assented to by the Quebec Legislature in May, 1909, replaced the prospecting permit, which were previously in force, by the Miner's Certificate; this is the equivalent of the Free Miner's Certificate of British Columbia, and to the Miner's License of Ontario. This certificate, issued on payment of $10.00, gives the right to prospect for minerals on all lands, of which the mining rights belong to the Crown, without giving exclusive rights over a large territory, as did the exploration permit. The bearer of a Miner's Certificate is allowed to stake five claims of forty acres each, or a total maximum area of 200 acres. This may be held for six months without having any payment to make. At the end of the six months, the holder has to take out a mining license, which is practically a leasehold, for which he has to pay a yearly rental of 50 cents an acre. Assessment work on the claims staked has to be performed to the amount of 25 days' labour during the first six months following the staking, and 25 days a year afterwards on each forty acres.

Mining lands can also be acquired by purchase, at the rate of $10.00 an acre for lands situated 20 miles or more from a railway, and $20.00 for lands nearer than 20 miles. Moreover, in case of purchase, all money paid as yearly rental on the mining license goes towards the purchase price of mining lands.

In this connection it is interesting to note that the United States Government has lately thoroughly studied the question of amending its "public land laws" with the object of encouraging the systematic and rational development of the mineral resources, with due respect to the principles of sound conservation of these resources. Commissions have been appointed to study the mining laws of various countries, and in this connection it is most interesting to quote from the report of Dr. George Otis Smith, the distinguished director of the United States Geological Survey.

In his last annual report, Dr. Smith very ably discusses the question of amendments to the United States mining laws, and the principles which he advocates as being the soundest for promoting the development of the mineral resources are as follows:

Separation of Surface and Mineral Rights.—"The first step, both in principle and practice, in an amendment of the land laws, appears that of making possible by legislation, the separation of surface and mineral rights whenever the two estates have values which can be separately utilized."

Compulsory Assessment Work.—"Most important, perhaps, in any amended mining law, would be provision for enforced development work, a principle expressed, it is true, in the present United States law, but not made effective in its workings. A requirement of actual use as a condition of occupancy of mineral land cannot be regarded as either novel or radical. As regards the large acreage of undeveloped land in many mining camps (in the United States) to which patent has already been issued, it is, perhaps, true that the situation is without relief, unless the Western Australia plan is adopted, whereby the Government steps in and permits mining under a lease, the proceeds of which are assessed, collected and paid over to the owner. The principle invoked seems to be that no property owner can rightfully oppose the development of the resources of the State.

"In the case of unpatented claims, a remedy should be sought, for what has been termed "the paralysis of mining districts," and the rigid requirement of annual assessment work should be made active and effective by inspection and supervision, in order to put an end to the present procedure of allowing a claim to be idle for practically two years after its location, not to mention the many localities where claims are held year after year with only perfunctory compliance or even without any performance of assessment work.

Leasehold System.—"The remedy, then for the existing evil of idle mining property must be sought in the adoption of leasehold, under which the Government can enforce operation, a system which fully attains the desired end of promoting mining development in Australia and New Zealand, or in the thorough revision of the present system. . . .

"The greatest advantage of the lease system to the operator directly, and the public indirectly, is relief from the large capital outlay now required in the acquisition of the large acreage absolutely necessary for a medium mine (this applies more particularly to coal). This argument advanced against the present policy of valuing the public coal lands at even conservative prices, thus becomes an argument for a leasehold law."

Oil and Gas Lands.—"The most urgent need of legislation (in the United States) for the disposition of mineral deposits, is in the case of oil and gas. First, the new law should authorize the issue of exploratory permits, granting to individuals or associations the exclusive privilege of occupation, the sole condition of such a grant being diligent and adequate prosecution of development, measured by the expenditure of fixed sums within certain periods, with possibly the payment of a small fee to the Government in lieu of expenditure during the first six months. In the second place, the law should provide that upon discovery, the holder of the permit be given a leasehold title with a royalty varied to meet the local needs and actual conditions."

The present mining law of the Province of Quebec practically embodies the above principles. By the mining law, sanctioned on July 24th, 1880, a separation of the mining rights from the surface rights was definitely effected. In all grants and patents issued since that date, they constitute two separate and independent properties, each subject to distinct separate regulations. In all patents issued before that date, the gold and silver mines were always reserved and still belong to the Crown, except in cases where these minerals have been specifically alienated.

A definite amount of assessment work is specially exacted, to be performed on all unpatented mining claims, and the yearly renewal of the mining license is made subject to the performance of that work.

Patents of claims are issued subject to a yearly performance of work to the amount of $200, or to an annual acreage tax of 10 cents an acre in the case of non-performance of the work.

The Quebec Mining License is practically a leasehold system at a fixed yearly rental per acre. If, after hav-

ing worked and developed a claim, the mining licenseholder wishes to, obtain a patent, he can do so by paying $10 or $20 an acre, according to distance from a railway. It has been objected that these purchase rates are high, but it must be remembered that the patent need not be applied for until the licenseholder has ascertained beyond all doubt the value of the mining claim, and in the case of a developed and proved mineral claim, these prices are insignificant relatively to the value of a mining property. Moreover, it is to be remembered that all money paid in as yearly rentals go towards the purchase price when the patent is granted.

The remarks of Dr. Smith regarding the oil and gas lands apply to the Province of Quebec, whose mining laws do not well apply to these substances, and they should be amended accordingly. There is at present a case in point, of a possibly valuable gas field which would benefit by more rational regulations.

The mining license as issued by the Department of Colonization, Mines and Fisheries, constitutes an absolutely secure title when the conditions, as set forth in the mining law, are fulfilled. These conditions are not at all onerous, and are very easy to comply with, and when this has been done, the Department is bound to renew the license; practically no discretionary power is left the authorities in this case. A certain amount of uneasiness seems to exist, due to the fact that the license expires yearly and is renewed for one year only, but such a feeling is quite unjustified. However, to allay it, it might, perhaps, be advisable to amend the law, permitting the issuance of longer leases, say 20 years, subject to the performance of the yearly conditions.

EARLY MINING LEGISLATION IN QUEBEC AND OTHER NOTES

By J. Obalski.

Under the French regimé little attempt was made to discover or develop the mineral wealth of the Province; and operations in these early days was practically confined to iron mining and smelting in the vicinity of Three Rivers, where in the "Forges du St. Maurice" charcoal iron was made from the bog ores. These ores, by the way, are still being utilized at Radnor and Drummondville.

In the issue of title of seigniories, the mineral rights were reserved to the Crown, under the old French law. The observance of this principle was maintained under English rule and is still recognized.

Copper was discovered in the Eastern Townships in 1860. The law as applying to these townships was not specific, and in consequence it was conceded that the owners of surface rights should also be entitled to the mineral rights. Notwithstanding this decision, patents have since been issued in which specified minerals have been reserved by the Crown.

Upon the confederation of the Canadian Provinces in 1867, Quebec, by the British North America Act, was conceded jurisdiction and control of its natural resources, including minerals. The old law respecting the reservation of mineral rights in seigniories, and of the Crown's prerogatives as regards the precious metals was not repealed. No legislation affecting the mining industry was introduced until 1874, when regulations were adopted governing the acquisition of mining laws, embodying the pinciples of license and purchase. A distinction was also made between the "superior" and "inferior" metals.

The apatite deposits in Ottawa County were discovered in 1878, and special regulations were made more especially for the protection of the farmers (the owners of the surface rights.)

The Quebec General Mining Act, sanctioned on July 24th, 1880, was, however, the first real attempt at constructive legislation applicable to the needs of the mining industry. It was framed by lawyers. Consequently, in some matters of practical importance it was deficient.

Shortly thereafter, the Quebec Bureau of Mines was established, but with very inadequate financial provision. The mineral industry was meanwhile beginning to assume importance. The phosphate industry flourished; development of the asbestos mines had commenced; while copper mining near Sherbrooke was being successfully conducted. In view of these conditions the Government of the time decided that the industry should contribute to the revenues of the Province, and legislation of a radical character was enacted in 1887, based on principles widely differing from those previously recognized. This legislation, though in many respects well-considered, was, nevertheless, premature, and was repealed in 1880. A new Act was adopted providing for a return, practically, to the original system. This Act was in force until 1908.

It is unnecessary to refer to more recent developments. The fact, however, that the Quebec Government has of late displayed an earnest disposition to promote the development of the industry in the Province, is a matter for sincere congratulation. The support now accorded the Bureau of Mines is encouraging. Its scope of usefulness has been greatly extended. Exploration and geological parties are now despatched every summer to investigate and report on the outlying areas and other means are taken to direct attention to our actual and potential mineral resources.

UNPROSPECTED AREAS IN QUEBEC.

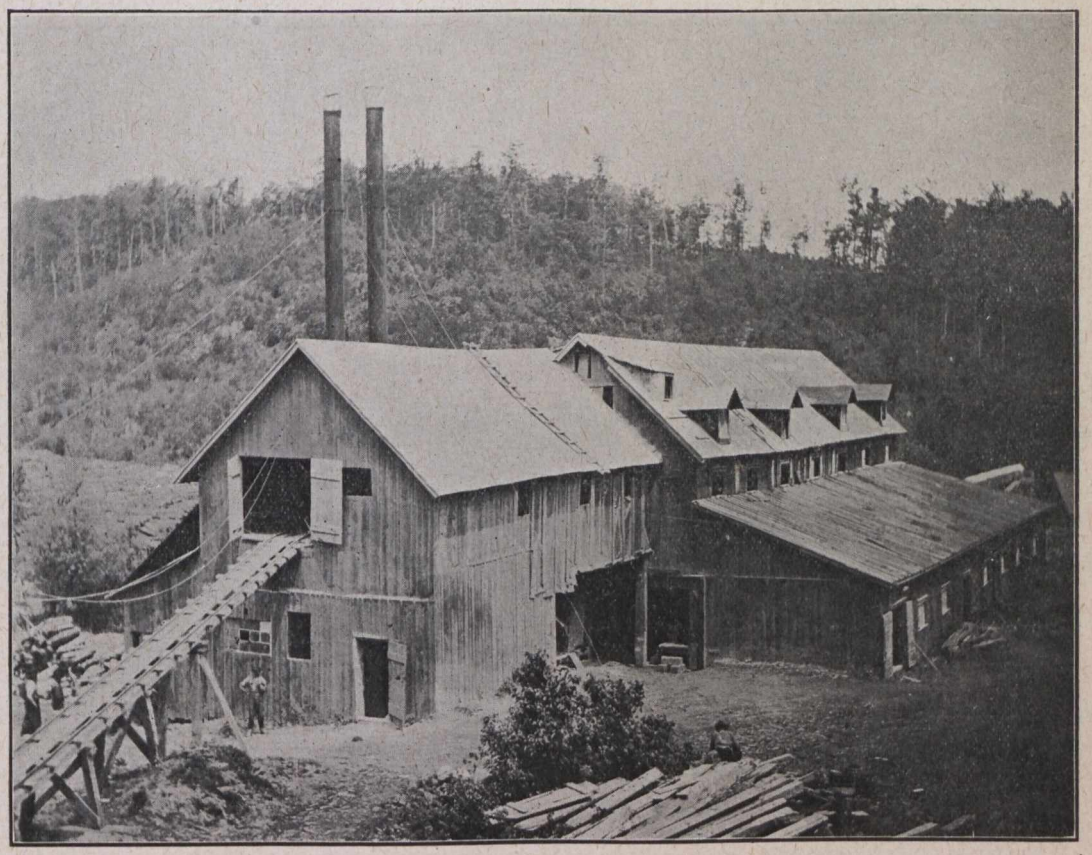
The area of the Province, prior to the addition of Ungava in March of this year, comprised approximately 352,000 square miles. With the inclusion of Ungava the area has been increased to over 700,000 square miles. Of this, 50,000 square miles is settled. In the settled districts mineral industries have been established and the resources are, in a relative measure, known. There thus remains 650,000 square miles of practically unexplored and unprospected territory, the greater part of which is underlain by rocks of pre-Cambrian age. There is, therefore, no Province in the Dominion in which the potentialities of mineral discovery and development are greater, and ere long this will be more generally recognized.

GRAPHITE IN QUEBEC

By H. P. H. Brumell, Buckingham, Que.

Notwithstanding the fact that graphite mining and refining have been carried on for a great number of years in the Province of Quebec, it is only recently that any importance has been attached to the industry. The present interest is occasioned not by new discoveries, but rather by the solution of the problems of concentrating and perparing the product for the market.

The workable ore deposits are in general of the disseminated type and the graphite contained is usually of such percentage as to necessitate the local treatment of the ore, the values rarely being sufficiently high to warrant shipment in the crude form.

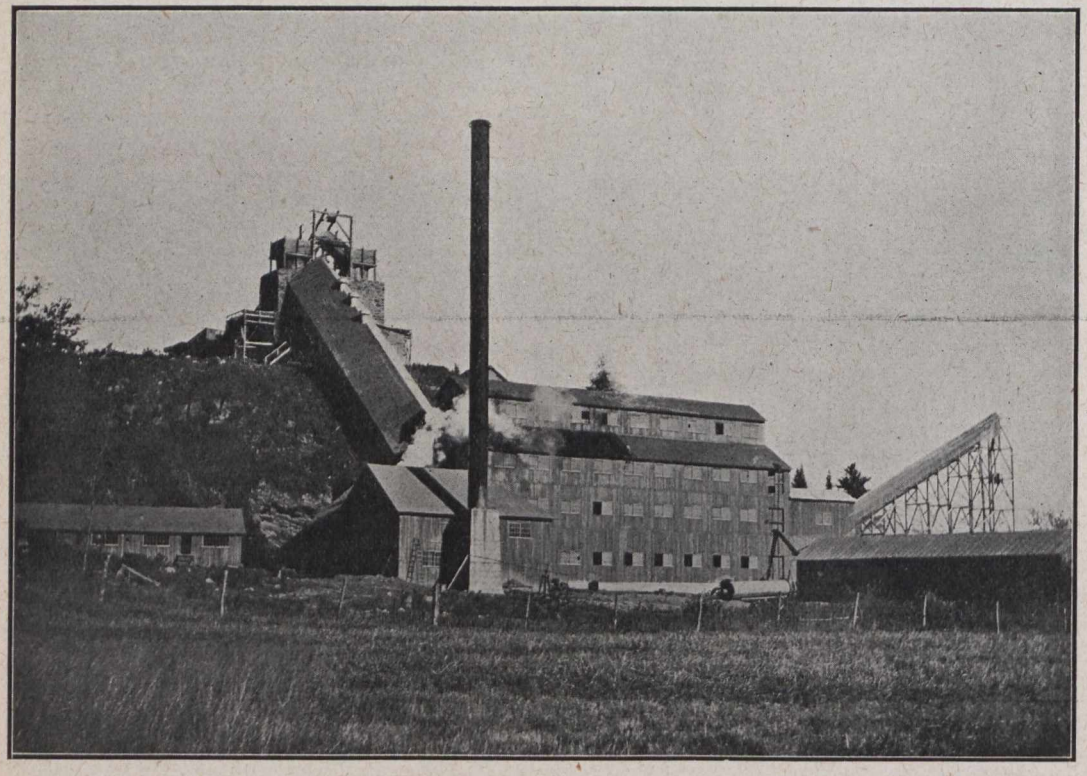


Buckingham Graphite Mill

While the mineral is largely distributed throughout the crystalline rocks of the Province, it has only been found in commercial quantity in the counties of Labelle and Argenteuil, both lying to the north of the Ottawa River. In these two counties, in the so-called Grenville or Hastings series of Laurentian rocks, it occurs both in disseminated and vein form, though, as previously stated, the former variety has alone proved valuable. In Labelle County, in the townships of Buckingham and Lochaber, are large areas of graphitic gneisses carrying from a trace to as high as 40% of graphite. The gneiss, where graphitic, is composed principally of quartz, orthoclase, sillimanite and hornblende, and, in places, mica; although when the latter mineral is present the ore is not considered workable. In Argenteuil County the usual gangue is limestone wherein the graphite is found in segregated masses and disseminated, the occurrence invariably being in the vicinity of intrusive rocks and it is at, or near, the point of contact that the greatest quantity of graphite is found. When occurring in limestone the usual accompanying minerals are wolaztonite, pyroxene, hornblende, quartz, and titanite with, occasionally, mica.

Space does not permit of more than a passing mention of the various efforts to produce merchantable graphite during early years. One of the first attempts was in the township of Buckingham, where, near Donaldson's Lake, a mill was erected shortly after 1867 and was operated, to produce stove polish stock, until about 1872. The following year the mill was burned and not rebuilt. Shortly after this a second mill was erected on the Blanche River in Lochaber township, and after unsuccessfully treating 600 or 700 tons of ore, was abandoned. This, in turn, was followed by the mill erected by the Dominion of Canada Plumbage Mining Company near Devine Lake, in Buckingham Township, in 1876, and shortly afterwards by the Pew & Weart mill, north of Donaldson's Lake, in the same township. Neither of these mills was successful. Coming down to more recent years, the North American Graphite Company erected a mill near Plumbago Lake, in Buckingham, in 1895 which after a checkered career and after having passed through several hands was remodelled by the Buckingham Graphite Company and became a large producer. This mill was followed, in Buckingham Township, by that of the Diamond Graphite Company and, later, the Bell Graphite Company, neither of which plants proved successful. The Dia-

mond Graphite Company mill was later purchased by the Peerless Graphite Company, who produced some high grade stock. The Bell Graphite Company mill was erected with the intention of utilizing an oil process which however, proved unsuccessful and efforts are now being made to make it pofitable by using an entirely dry process. During 1911 The Dominion Graphite Company erected a large mill, also in Buckingham Township, which is operating successfully at the present time. In Argenteuil County, the only mill erected was that of the Calumet Mining and Milling Company at Calumet. This mill had but a very short career partly on account of lack of ore but principally by reason of the method of refining. At the present time a mill is in course of erection at St Remi d'Amherst on property owned by Graphite, Limited, Montreal, who have opened up and developed to a depth of, it is said, 100 feet, a deposit of considerable extent.



Dominion Graphite Co. Mill

It has not been thought necessary to make more than the foregoing brief mention of the various mills of the Province to the ill-success of most of which is attributable the long delayed success of the industry. That the Province is capable of producing and supplying, in large quantities, a very high grade graphite is evidenced by the operations during the past year of the Dominion Graphite Company, which company is now producing considerable quantities of a high percentage crucible stock of high refractory power which finds a ready market with the crucible makers of the United States and Great Britain. The crucible maker demands for his purpose a crystalline graphite high in carbon and low in iron and lime with absolute freedom from mica, all of which conditions are now obtainable from a properly sorted ore when treated according to modern methods.

As is usual in the inception of any business or industry regarding which there is but little definite information available, the various operators are very secretive as to their methods and operations, and it is therefore impossible to write authoritatively regarding them. The companies that were active during the past year were:

The Buckingham Graphite Company, lot 28, range vi, Township of Buckingham. Capacity of mill, 100 tons of ore per day.

The Bell Graphite Company, lot 2, range v, Township of Buckingham. Capacity of mill about 50 tons of ore per day.

The Peerless Graphite Company, successors to the Diamond Graphite Company, lot 14, range x, Township of Buckingham. Capacity of mill about 40 tons per day.

The Dominion Graphite Company, lot 20, range v, Township of Buckingham. Capacity of mill 250 tons of ore per day.

During the past five years there has been a steady growth in the production of graphite in the Province of Quebec and it should be borne in mind that this entire output is of finished material as no crude ore was shipped.

Annual production of graphite:

Year.	Tons.	Value.
1907	....	$ 5,000
1908	....	165
1909	134	10,176
1910	155	15,896
1911	377	33,588

As illustrative of the possibilities for the graphite industry in this province the following tables may prove of interest.

World's production of graphite.

Year.	Short tons.	Value.
1904.....	100,922	$3,063,386
1905.....	118,938	3,165,439
1906.....	128,793	4,315,965
1907.....	143,930	3,818,842
1908.....	106,741	3,410,130
1909.....	115,823	4,177,762

The distribution of the world's production during the last two years available was, as follows:

Country.	Quality. 1908.	Value. 1908.	Quantity. 1909.	Value. 1909.
	Tons.		Tons.	
Austria	48,970	$ 349,118	44,875	$ 320,289
Canada	251	5,565	863	45,999
Ceylon	28,916	2,593,160	36,056	3,237,751
Germany	5,340	60,264	7,467	64,724
India	3,218	69,814	3,508	60,972
Italy	14,235	71,758	12,768	71,148
Japan.	195	8,592	136	5,290
Mexico	1,742	28,426	1,878	25,301
Norway	1,192	13,005	.....	.....
Sweden	73	2,046	29	779
Queensland	22	292	.....	.....
United States ..	2,587	208,090	8,243	345,509
	106,741	3,410,130	115,823	4,177,762

As all the graphite produced in the Province of Quebec is of the so called crystalline quality, the material from Ceylon and part of that from the United States constitutes, at present, the only competitive product, as, with the exception of a small quantity of a very small flake produced in Bavaria, the production of the other countries is of amorphous material.

Assuming the foregoing statement to be correct there is an annual production of crystalline graphite as follows:

Year	Ceylon Tons	Ceylon Value	United States Tons	United States Value	Total Tons	Total Value	Value per ton
1904	28,909	$2,090,747	2,840	$238,447	31,749	$2,329,194	$73.00
1905	34,319	2,323,184	3,018	237,572	37,337	2,560,756	69.00
1906	39,303	3,388,227	2,944	238,064	42,247	3,626,291	86.00
1907	36,406	2,889,596	2,474	171,149	38,880	3,060,745	79.00
1908	28,916	2,593,160	1,140	132,840	30,056	2,726,000	90.00
1909	36,056	3,237,751	3,147	313,271	39,203	3,551,022	90.60

In conclusion it may be safely said that there is now open to the praphite producers of this province a market that is now absorbing $3,500,000 worth of graphite for which it is paying at the rate of $90 per ton at the point of production. This average price should easily prove profitable to the producers of the Province.

THE AMHERST GRAPHITE MINE

Written for the Canadian Mining Journal.

Although graphite was discovered in Amherst Township ten years or more ago, no systematic attempt to develop the occurrence was made until quite recently, when a large area, some 700 acres, was acquired by a Montreal syndicate, near St. Jovite, a station on the Nomining branch of the Canadian Pacific, a distance of about 80 miles from Montreal. This syndicate has made a very considerable expenditure in the last few months in developing the property, and in plant and equipment. Most of the exploration work has been done on exposures on lot 16, range 6, of Amherst Township. The principal ore-body is said to be 20 feet wide, striking north-east 65 degrees, with a dip of 60 degrees to the south. Here a vertical shaft has been sunk to a depth of a hundred feet and drifts run at 40 and 100 feet respectively. There is also an upraise from the 40-foot level to the surface, and from the 100-foot to the 40-foot level. This work has resulted in the development of a large ore suply—sufficient, it is affirmed, to justify the milling-plant now under construction. Mr. Fritz Cirkel, the syndicate's consulting engineer, thus describes the physiographical and geological conditions of the locality.

Physiographically the region is one of undulating hills, not exceeding an altitude of 300 feet, and are composed of flesh-coloured gneiss or granite. The country is dotted with little lakes connected by small creeks draining towards the south by the Maskinonge River into the Rouge River, a tributary of the Ottawa.

The principal rocks in this district are practically confined to the crystalline gneisses and limestones of the Grenville series. These crystalline limestones, gneisses and quartzites are intruded by numerous masses of eruptive rocks, such as pyroxenite, granite and less frequently by diorite and diabase. The general trend of the series is north-east. Locally, the series is contorted, dislocated and interrupted by faults which may be followed in some instances over long distances. The graphite deposits occur within eruptive rocks, striking between N.E. 62 and N.E. 70 degrees, with a dip of between 50 and 65 degrees to the east. Exploration work appears to indicate that the deposits, as yet developed on the surface, occur within a range of from 150 to 250 feet, covering a distance of over two miles. Lenticular masses and pockets of graphite varying in size from a few inches to several feet in diameter, small veins, disseminations, branches, apophyses, nests, kidneys and irregular aggregations of the mineral, together with the gangue, constitute alternatively these bandlike portions of the ore zone. Development has also demonstrated that the larger bodies occurred within certain limits and along definite zones, which suggested that

Ore Dump, Graphite Limited

mining should be carried on by shafts and drifts. The graphitic portions of the ore zone on the surface are between 10 and 12 feet wide, in some places wider, the main portion consisting of graphite scales and flakes or radiated individuals. The larger flakes, some of them one or two inches square, when freshly found are prevailingly curved, as though from pressure. They break in the direction of the platy structure into more or less angular aggregates, being composed of thin, narrow foliae of uniform width. Blocks of this almost pure graphite have been taken out measuring 1½ to 2 cubic feet. This class of ore is designated as "crude" or "cobbing" ore, and contains, according to the quantity of rock matter mixed with it, from 65 per cent. of fixed carbon and upwards. The very pure aggregates of crystals have a fixed carbon content varying between 92 and 98 per cent. A portion of this crude material was crushed to flakes, and the latter analyzed. The purity of these flakes was found to be 95.60 per cent.

The other class of ore taken from the deposits is designated as the disseminated variety, or milling ore. It is composed of streak and lense-like accumulations of flakes of the smaller size, the gangue consisting, in the main part, of feldspathic, pyroxenic rock-matter and wollastonite.

The ore of the Amherst deposits is remarkably free of these objectionable admixtures which usually impede the successful extraction of the graphite from the gandue, or render even the refined article unfit for the manufacture of most of the graphite products. There is no iron, mica, or pyrite (with its most objectionable sulphur) present, while lime remains in almost all the average tests so far made below the permissible medium, that is, below 5 per cent. Most of the graphite is

Excavation for Mill, Graphite Limited

Crude Ore, Graphite Limited

associated with feldspar or pyroxene, less frequently with wollastonite or calcite.

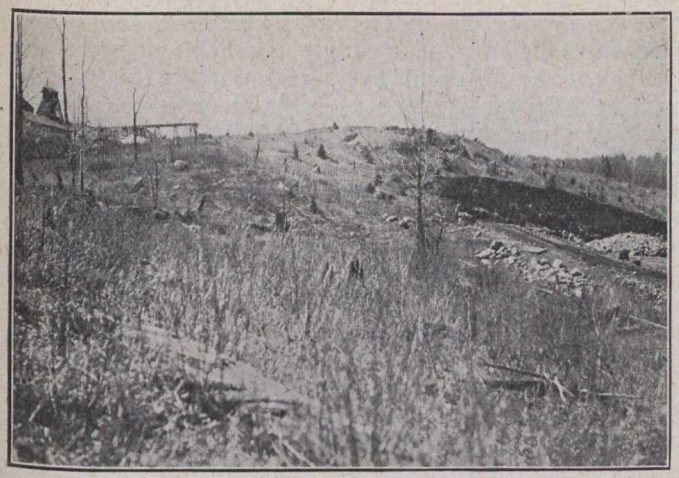
A selected sample containing much calcite gave, upon analysis by Prof. Chas. White, of Harvard, Cambridge, Mass., the following composition:

Moisture	0.3
Carbonic Acid	4.26
Other volatile matter	1.12
Free Carbon	54.75
Ash	39.74
	100.00

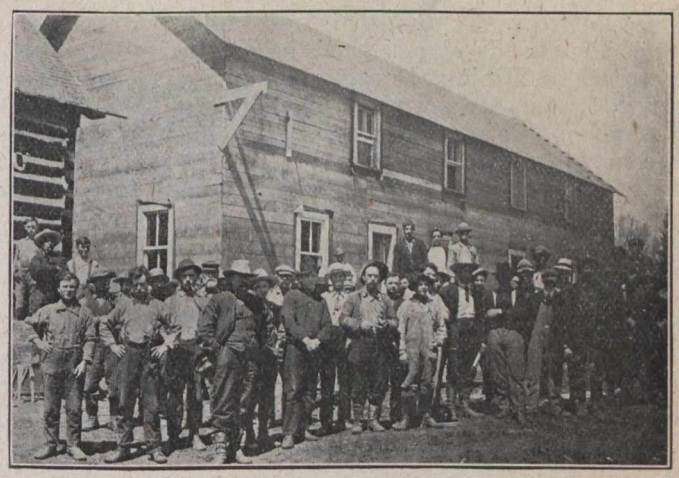
The mineral composition resulting then as follows:

Graphite (carbon)	54.75
Feldspar	34.32
Lime	5.42
Carbonic Acid Gas	4.26
Volatile matter	1.12
Moisture	0.13
	100.00

The Krupps, Essen, offer $150 per ton for the refined product. The machinery now being installed at the mine includes hoisting equipment, a 60 h.p. boiler, 4-drill compressor, and Cameron pump. The mill is designed to eventually treat 200 tons daily, but the present capacity will be limited to 50 tons. The mill construction is being directed by Mr. C. Brewer, whose process is to be utilized. The syndicate is employing —on mill construction and in mine development work— over a hundred men. It is expected that ere long rail facilities will be provided between Amherst and the mine by the construction of a spur from the Canadian Northern, the location of which is now being surveyed.



Graphite Limited, Shaft House to left, Mill Site to right



Mining and Construction Crew, Graphite Limited

THE SPECIAL RESEARCH WORK OF THE MINING DEPARTMENT OF McGILL UNIVERSITY

Written for The Canadian Mining Journal.

McGill was the first of the Canadian Universities to give instruction in mining and metallurgy as a regular course in 1871*, and again the first to create and equip an independent department exclusively devoted to the subject in 1896, and while several of the other important universities now also have mining schools, McGill still holds the premier place, with a staff of five professors and assistant professors, of lecturers and instructors and a dozen other employees all engaged exclusively in the departments of mining, geology, and metallurgy.

The regular work of McGill, however, is so well known that it is unnecessary at this time to describe at length either the equipment of its laboratories or the details of its courses of instruction, and all that need be said in this connection is that the University provides regular degree courses in mining engineering, mining geology, metallurgical engineering, and metallurgical chemistry, as well as in numerous other branches of science not especially related to the mining industry.

In addition to the regular business of giving instruction in the above named courses the University is now doing a great deal in the way of advanced teaching and investigation. Some work of this character has been going on for many years, as for example the extremely valuable researches of Dr. Adams and his associates on the flow of rocks, and allied matters relating to theoretical geology, but in the last few years a number of economic researches have been undertaken, the most important of which is the study of the coals of the Dominion by Dr. Paton, aided by Professor Dudley and others. The magnitude of this single investigation may be judged from the fact that a considerable staff were engaged on it for four years, and that six large volumes of reports have been printed and a seventh volume is now in preparation.

The cost of the coal research above referred to and a similar investigation now being carried on by Dr. Stansfield on the electric furnace treatment of zinc ores, are being met in large part by the Dominion Government, it being the wise policy of Dr. Haanel, the Director of Mines, to enlist the assistance of outside specialists in the work of developing the mineral interests of the country, but the investigators them-

* Editor's Note: Queen's University will dispute this statement.

selves are being made in the laboratories of the University by members of the staff of the Department of Mining and Metallurgy.

In addition to these special semi-public investigations the Department has for many years found time to carry out a certain number of researches on some of the many problems which are constantly arising in ore dressing, cyaniding, metallurgical treatment of ores, etc, and of late this part of the work has been greatly strengthened and extended in connection with the organization and development of the University Graduate School. The Mining Department now possesses three endowed scholarships and the Metallurgical Department one, thus making it possible to keep four picked graduates constantly engaged on research. These scholarships, or fellowships as those in mining are called, are eagerly sought for by the ablest men in the graduating classes and the successful fellows are given a full year for advanced study and investigation clear of any conflicting obligations.

These research fellowships have proved most useful in more ways than one, their primary object is, of course, to give advanced and specialized training to certain of the best men in each class, but incidentally all of the students in mining are helped by the work which is being done in the laboratories by the fellows, and are stimulated by their successes.

As stated above, the first object of the fellowships is educational, but the research subjects are so chosen that the results are often of great value. For example, a series of investigations has been carried on by a succession of fellows during several years on rock crushing, and the consumption of power has been very accurately measured for several standard types of crusher, working on different kinds of rock and crushing to different degrees of fineness. The result of these experiments is to finally disprove the "law" of crushing originally enunciated by Rittinger and accepted by nearly all authorities since his day, and to show that the more recent theory advanced by Kick is either true or so nearly so that it affords a close working approximation to the truth.

Kick's "law" was originally stated in 1885 as a general proposition in mechanics, and it is only within the last few years that it has been applied to ore dressing first by Stoden in South Africa, and more recently by the McGill staff. Put in terms of rock crushing it may be stated as follows: The power necessary to crush a given quantity of any given rock from any known size to any other known size, will be directly proportional to the reduction in volume of the particles —in other words have a ton of rock all in pieces say 1 inch in diameter, it will take almost three times as much power to crush them to pieces ½-inch in diameter as to pieces ¾-inch in diameter; or it will take twice as much power to crush from 1 inch to ¼-inch as from 1 inch to ½-inch.

The law as above stated is of course impractical first because it makes no allowance for the imperfections of the crushing machinery or for the difference between one kind of crusher and another, and second because it is not a practical possibility to feed a crusher with rock all broken to exactly the same size, still less to produce crushed grains all of the same size; but as Stoden has pointed out, if the law is theoretically true, it is possible to take any quantity of mixed rock, and by sizing it before crushing and weighing the different sizes then crushing say half the lot in one machine and the remainder in another, and finally by again sizing and weighing the products, it is possible to determine the relative useful work done by each machine, or in other words to determine the comparative efficiencies of different crushers.

The McGill experiments were first directed to settling the question of the truth of the theory and, as stated above, the results of a very large series of experiments agree with the law to within the reasonable limits of error of experiment on so variable a material as broken rock. The next thing to be done was to compare the efficiency of a single crusher, say a Gates breaker, over different parts of its range: i.e., to determine whether it gave as high an efficiency when working from say 4-inch to 1-inch as from 4-inch to 2-inch or from 2-inch to 1 -inch; and similarly to study other crushers such as stamps, rolls, tube mills, etc., with a view to finding the most efficient range of each machine and the comparative efficiencies of the different machines.

Obviously the amount of ground to be covered is enormous, especially as the experiments have to be carried out on a large scale yet with the utmost care to eliminate errors. Therefore, only a small part of the work has as yet been completed, but enough has been done to justify the preparation of a preliminary report which is now being prepared for publication and it is confidently believed that it will soon be possible to state with a very considerable degree of certainty just what types of crusher are most suitable for particular degrees of crushing, and to state what output may be expected for any rock for which the confines have been determined.

The activities of the research men have by no means been confined to rock crushing. The modern classifier has been investigated, and improvements which are the outcome of these tests are now in turn being tried out. The Wilfly table has been tested under varying conditions of feed. The amount of moisture necessary to give the best results in tube mills and Huntington mills has been studied. The question of heating and possible spontaneous combustion of coal in storage has been given two years of study, and a number of other matters including several geological questions have been either worked out or are now under investigation.

Another interesting and useful feature of the work at McGill is the practical class in mining which is held each year. This field class was instituted in 1897 in a very modest way, but it has grown so important until it is now one of the most effective parts of the course. As at present conducted the whole of the third year class go to the field with a supplementary party of second and fourth year students. The Professor of Mining, Dr. Porter, the Assistant Professor Mr. Bell, the Associate Professor of Geology, and from two to four junior members of the staff accompany the party and from four to five weeks of actual work are done in field geology, in visiting mines, concentrating mills, and smelters, and in underground surveying. The party lives in a train of chartered cars, sleepers, diner, and baggage car, and visit the most interesting districts in the country. In this way the Eastern Townships of Quebec, the coal and gold regions of Nova Scotia, and by boat the iron ores of Newfoundland form one year's excursion. Another year's work and it is the favourite of the students to visit in excursion Cobalt, Sudbury, the Crows Nest Pass, and Rossland in B. C.

Occasionally visits are made to the United States, thus the iron mines of Ticonderoga in New York the

Pennsylvania anthracite mines and slate quarries and the New Jersey copper smelters made one year's excursion, while Cobalt, Sudbury, and the iron and copper regions of Michigan have afforded good alternative to the British Columbia excursion above named.

It should also be explained that these excursions are but the introduction to serious work as the student members of the party are required to obtain and are aided in obtaining engagements at the mines visited for the remainder of the services and thus spend a total of over four months in practical work before beginning the studies of the final year.

The value of this practical excursion under the guidance of competent instructors, can not be exaggerated. Without it the men would have but a very vague idea of the professional side of their studies, but thanks to the field work they are able to gain a much more thorough insight both to theoretical studies and to practical work than could otherwise be possible.

THE QUEBEC CHINA CLAY INDUSTRY

Written for The Canadian Mining Journal by James G. Ross.*

One of the newest industries being developed in the Province of Quebec is the mining and refining of kaolin or china clay, which is being carried on at St. Remi d'Amherst. The bulk of the china clay used in the industries of Europe and America is produced in the West of England, principally in Cornwall. Many of the clay mines there were worked originally for tin, some as early as the reign of Henry VII. Since 1834 they have been worked for china clay. The output last year reached 750,000 tons. As only one-fifth of the amount dug is clay an immense amount of quarrying must be done to recover this amount of marketable product.

Very little first-grade china clay is produced in the United States, and that in the southern part. The majority of the clay there is of sedimentary formation and so tinted by iron oxides that it does not command the price of the pure white residual clays of Cornwall and Canada.

*Mining Engineer, the Milton L. Hersey Co., Montreal.

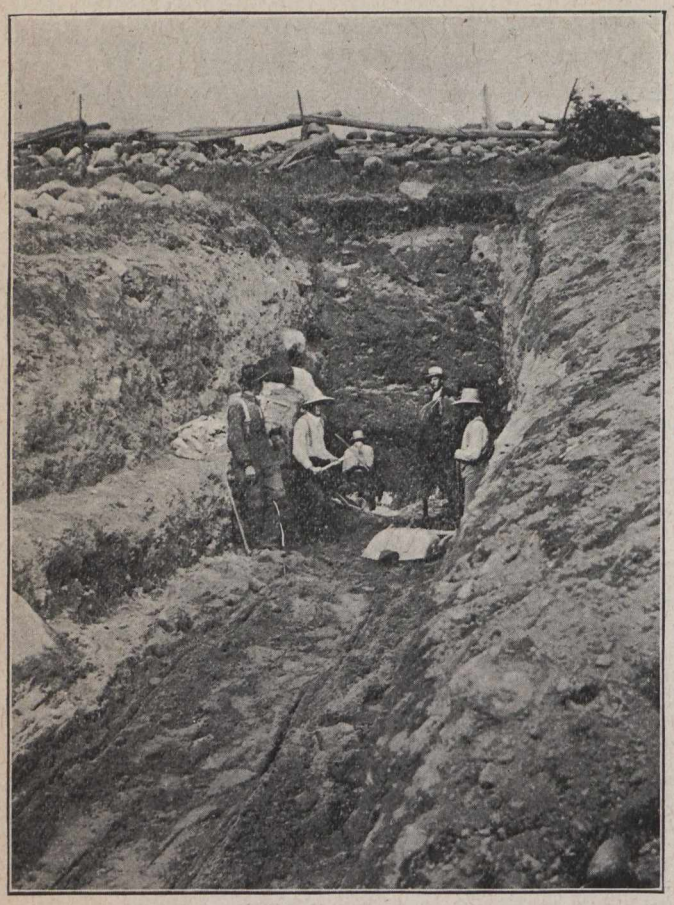
Location.

The works of the Canadian China Clay Company, the first company to operate china clay deposits in Canada, are situated two miles from St. Remi d'Amherst and seven miles from Huberdeau Station, the terminus of the Canadian Northern Quebec Railway, 94 miles north of Montreal.

In a little valley in the Laurentian Hills, surrounding Lac du Sable, after the pine timber had been cut and floated down the Maskinonge River, a settlement of habitants, mostly of the family of Tassé, grubbed the stumps and settled down to win a living from the soil lying between the rocky ridges. Some fourteen years ago in digging wells near their log cabins the settlers came on a white substance at the rock level under some twelve feet of overburden. The only use they found for it was to mix it with water and whitewash their houses.

Washing Plant, Canadian China Clay Co.

The late Dr. R. W. Ells, of the Geological Survey, in his report on the County of Ottawa in 1901, mentioned the occurrence of kaolin on the farm of Philibert Tassé, Lot 5, Range VI. South, Township of Amherst, County of Ottawa. One F. R. Lanigan, with others, staked parts of this and adjoining farms, in all some 124 acres. The St. Remi Kaolin Company was formed, and



First Find of Clay, Canadian China Clay Co.

desultory attempts at prospecting made. Trenches were started but were not carried deep enough to uncover the rock. No further work was done until 1910 when several pits were dug disclosing clay in so many places that a French engineer was led to report the presence of a bed of it. A shipment of several tons was made to Montreal, an experimental washing trough erected in the lumber yards of Mr. A. Shearer, and samples comparatively free of grit obtained. A quantity was also sent to Chicago and experiments made to refine it by air processes. Analyses and colour tests made by The Milton Hersey Company, Limited, and by others proved the St. Remi clay to be of the first grade and equal in colour to the best English China clays.

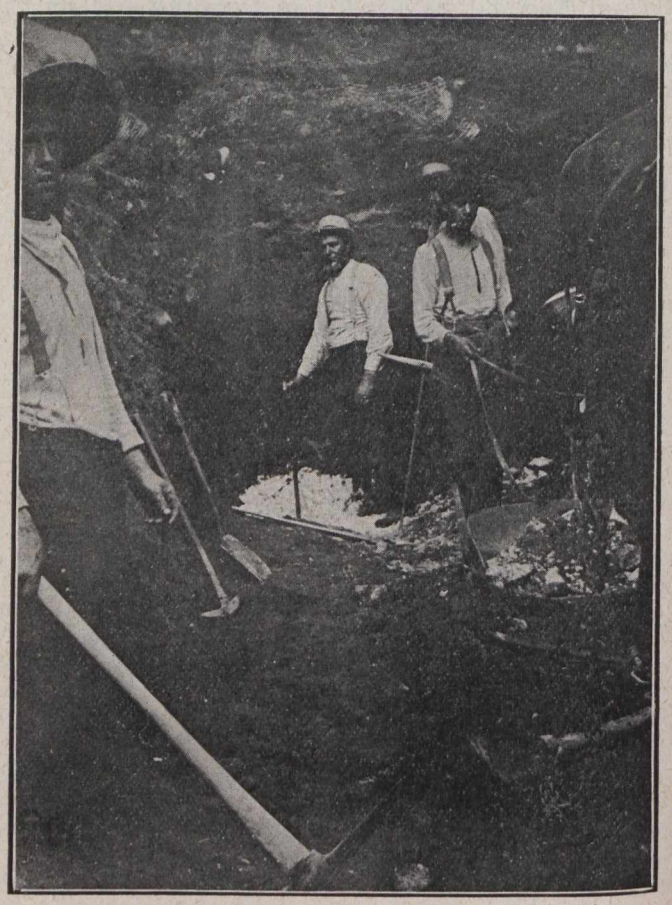
Geology.

In Cornwall the clay occurs as veins resulting from the decomposition of feldspar in situ in pegmatite granite. Collins, an English clay authority, describes them as "areas of irregular form, generally much elongated and extending to an unknown depth. Many beds of it extend for a distance of a quarter of a mile or even more, in the direction of the veins, while their breadth may be only a few inches, and seldom exceeds one or two fathoms; very wide masses of it are wrought in many places, but these are invariably associated with groups of parallel veins."

The occurrences at St. Remi bear a striking resemblance to this description. The veins are in a quartzose gneiss, one of the first veins struck, however, had a width of eighteen feet, thus being greater than the maximum width mentioned by Collins for the Cornish veins. The veins so far uncovered have a strike N.W.-S.E. along the easterly side of hill. Higher up the hill to the east the gneiss is less friable, and contains only specks of clay. This seems to be also a characteristic of the English rock on the higher levels. Across a valley to the west is an outcrop of crystalline limestone containing flakes of graphite and mica.

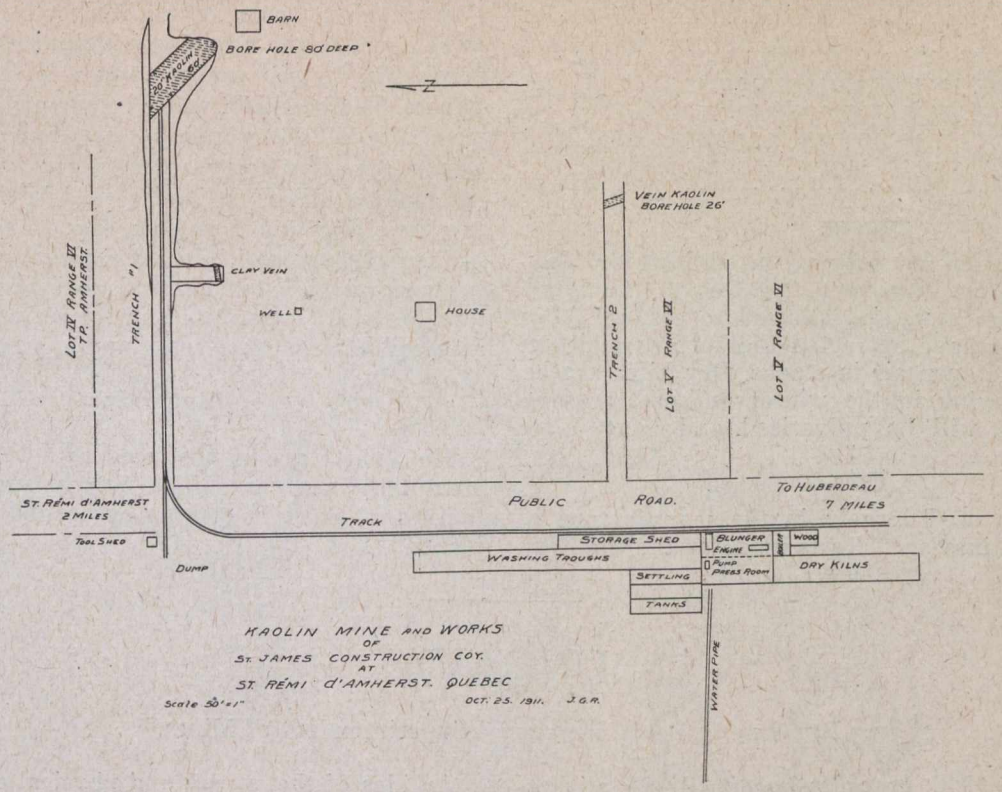
Operation.

Messrs. Andrew Shearer and J. C. Broderick having obtained a lease of the property from the St. Remi Kaolin Company formed a company in Montreal to operate the deposits. In June, 1911, the writer examined the properties and prospecting was commenced by digging two trenches easterly into a side hill in a cultivated field. From a preliminary investigation the conclusion was reached that the deposits were veins of



Boring a Vein of Kaolin

kaolin and not beds as formerly supposed. In the southerly trench rock was first exposed showing the formation to be a gneiss composed almost wholly of a quartzose rock with fine lines of kaolin. The lines of kaolin gradually widened until a vein four feet in width was crossed. This vein was evidently a decomposed feldspar and carried only five per cent. of quartz grains. A 2½-inch bore-hole was sunk in this vein to a depth of thirty feet and was still in good clay when stopped. About this time a larger vein was struck in the northerly trench which on crossing developed a total width of eighteen feet. Bore-holes were sunk in



this to a depth of 80 feet, and the bottom of the deposit not reached. The dip of the vein was almost vertical and the strike N.W.-S.E. Several smaller veins ran parallel to it, separated by stringers of rock. The vein was uncovered along its length for a distance of 60 feet. Several other occurrences have been found on the property in wells and pits but have not yet been developed.

Plant.

Before laying out a plant for refining the clay a study was made of the processes in vogue in England, where a large quantity of raw material is treated to secure the china clay. As the drying is effected partly by natural evaporation, large open-air vats are required. As it was intended to work the year round at St. Remi provision had to be made for the winter weather here. Clay washing plants in the Southern States were visited and the method of extracting the surplus water from the clay by means of filter presses was found to be working satisfactorily. As every clay requires a different treatment experiments were conducted until a system suitable for this clay was devised. The style of plunger, mesh of screens, quantity of water, length, depth, width and pitch of elutriation trough, size of settling tanks, design of filter press, weight of duck, and design of dry kiln, all had to be considered. These features having been decided, a plant was designed which proved satisfactory, and after the usual delays incident to the establishment of a new industry, in April of this year, the Canadian China Clay Company had the satisfaction of producing a china clay of superior quality and colour, free from grit. An analysis of the clay produced, as determined by the Milton Hersey Company, Limited, is as follows:—

Silica	44.43
Alumina	40.48
Oxide of Iron	0.039
Lime	0.24
Magnesia	0.36
Sulphuric Anhydride	None.
Combined Moisture, Carbon Dioxide and Organic Matter	14.46
Residue on flotation test	Trace.

Dana gives the composition of china clay or hydrous silicate of alumina as: Silica 46.40, alumina 39.70, water 13.90.

Another View of Washing Plant

Fairie gives the following description: "China clays possess very characteristic properties. They are of a loose earthy texture, and light, friable in the hand, meagre to the touch, and do not readily form a plastic paste with water. Their composition is different in different localities, the limits being very wide. The following analysis is that of their average composition":—

Silica	46.32
Alumina	39.74
Oxide of Iron	.27
Lime	.36
Magnesia	.44
Water	12.67
Loss	.20

Process.

The clay is mixed by digging, no chilling or blasting being necessary, trammed 600 feet to the plant, washed free from grit, and allowed to settle. After the filter presses have extracted the surplus moisture it is dried in the open air in stacks. Dry kilns are being built for drying in the winter and wet seasons. After drying it will be pulverized and bagged for shipment.

Uses.

China clay is used largely in the manufacture of porcelain and chinaware. Tests made of the St. Remi clay at the potteries of East Liverpool, Ohio, show it to be equal to the best English china clay for this purpose. The largest use in Canada is for coating white papers. The beautiful white colour of this clay and the proximity of the works to the Canadian paper mills ensure a market for the output for some time for paper making alone. It is also used in the textile industry for sizing and bleaching calico and cotton, in the rubber industry and in paint manufacture as extender; for making high tension and ordinary electric insulators, chemical apparatus, and for refractory ware, such as crucibles and other assaying apparatus.

By-product.

The quartz grains produced as a by-product, which assay 99.60 per cent. silica may be used in the manufacture of glass, in making carborundum, and in filter plants.

UNGAVA

By Theo. C. Denis, Provincial Superintendent of Mines.

On May 15th, 1912, an order-in-council officially extended the boundaries of the Province of Quebec, in accordance with a bill passed previously by both Houses of Parliament of the Federal Government. Quebec has now jurisdiction over Ungava, and thereby the area of the province has been increased from 351,000 square miles to 708,000 square miles, or more than doubled in size.

Ungava is the "hinterland of the hinterland" of the Province of Quebec, and as such is, of course, very little known. Our knowledge is limited to the shores of Hudson Bay and James Bay, which have been explored to some extent; hasty traverses also have been made of some of the principal streams heading in the elevated land of the interior, which once was the nevé gathering ground or distributing centre of the Labradorean ice sheet, the activities of which extended radially for hundreds of miles.

It is to Dr. A. P. Low that we are indebted, deeply indebted, indeed, for practically all we know concerning Ungava. As a field-officer of the Geological Survey, he carried on several scientific explorations in this territory, and his maps and reports are models of lucidity, as well as a tribute to his power of observation, his endurance and his modesty.

Low's explorations in the interior of the northern part of Labrador peninsula embraced the following streams which are given with approximate distances of the routes travelled. The report and maps bearing on this work were published as Part L. of the annual volume of the Geological Survey for 1895:

East Main River, about 400 miles.

Koksoak, Kaniapiskau Rivers, and Lake Nichicun, about 600 miles.

Hamilton Inlet, Hamilton and Ashuanipi Rivers and long series of lakes in the central part of the peninsula, over 600 miles.

Big River, Bishop Roggan and part of Great Whale Rivers, 250 miles.

Richmond Gulf, Still Water and Larch Rivers, 300 miles.

An idea of the energy and physical endurance necessary to carry on that work may be had from the fact that in one campaign of seventeen months, which necessitated wintering on Hamilton Inlet, Low's party travelled 5,460 miles, of which 2,960 miles in canoes, 1,000 on foot; 500 with dog teams, and 1,000 in a steamer.

Physical Features.

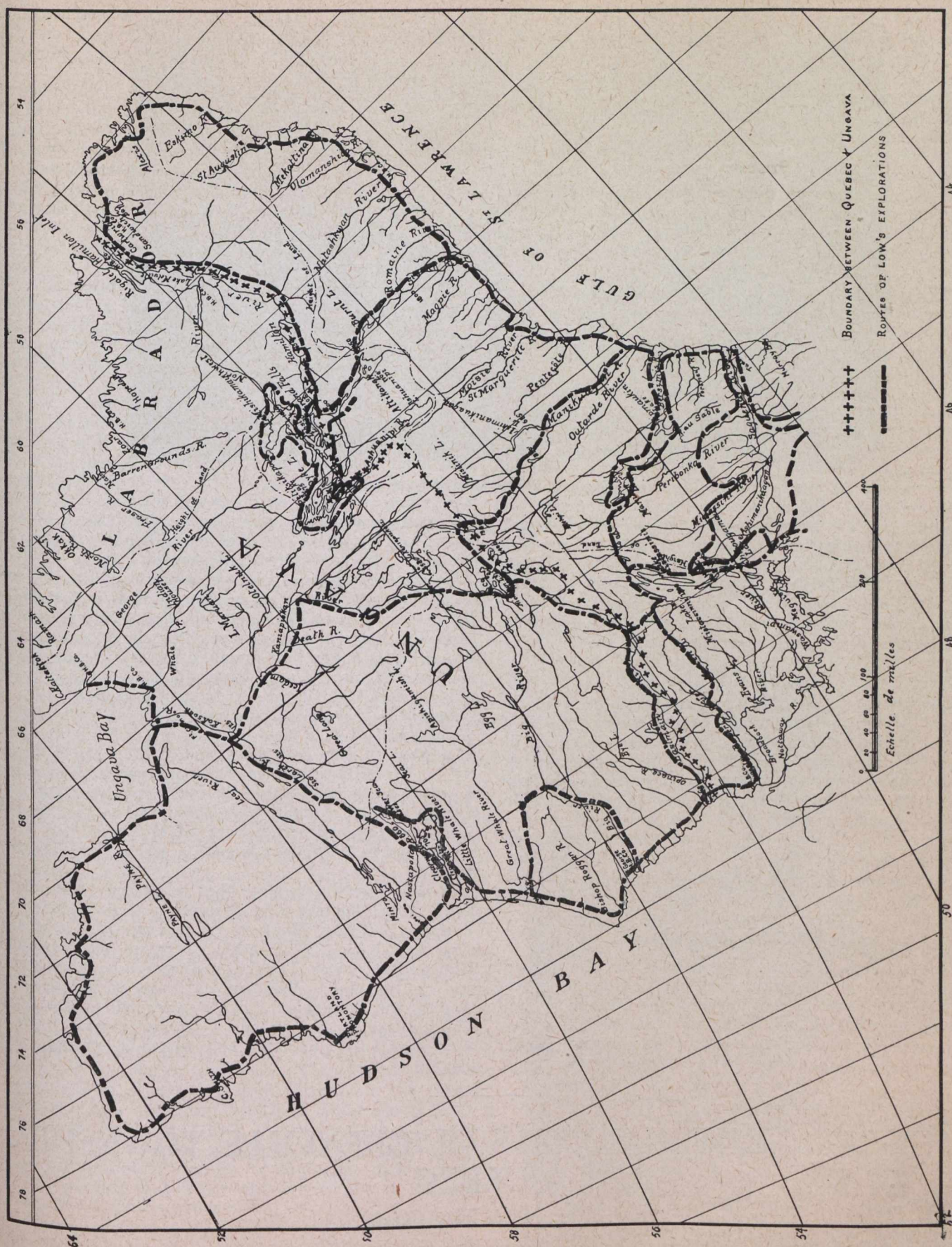
According to Low, the peninsula of Labrador is a high rolling plateau which rises somewhat abruptly, within a few miles of the coast line, to heights between 1,300 and 2,000 feet. The interior country is undulating and is traversed by ridges of low hills.

Along the Atlantic coast, however, the land rises abruptly, inland, and to the northward of Nain, the coast range is much higher. In the neighborhood of Nachoak Bay, unglaciated mountains rise abruptly from the sea to heights varying from 2,500 to 4,000 feet. This range appears to be confined to the coast region and is probably under fifty miles in width.

Geology.

By far the greater part of the country is underlain by Laurentian gneisses. A large area of Huronian rocks is met with on the East Main River from a few miles above its mouth, for 160 miles. This is the most extensive development of these rocks encountered on the peninsula. Other smaller Huronian areas have been described by Dr. Bell as occurring between the East Main and Big River. Low also observed a small patch of these rocks on Great Whale River.

Two large patches of Cambrian rocks are mentioned in Low's reports. One on the Koksoak River and another on the Upper Hamilton. It is possible and even probable that these two areas will be found on further investigation to be one continuous belt, which in that case would be 400 miles long. In one place, the width was ascertained to be about 50 miles. The rocks constituting this belt are slates, dolomites, sandstones, and siliceous iron beds. Although they are indicated as Cambrian on Low's map, later petrographical correlation would tend to classify them in upper Huronian,



corresponding probably to the Keweenawan of the Lake Superior region.

Climate, Soil and Trees.

The climate ranges from cold temperate on the southern shares to arctic on the Hudson Strait. In the territory which has just been added to the Province of Quebec, it is only on the low grounds, near the coast, that a little agriculture can be carried on. Along the

east coast of James Bay crops of potatoes and other roots are grown as far north as Fort George, latitude 54°. On the Atlantic coast, similar crops are easily cultivated about the head of Hamilton Inlet. At Nichicun, several attempts have been made to grow potatoes, but without success, owing to summer frosts in July and August.

The soil of he greater part of the peninsula is derived from the underlying archean rocks. It is a mixture of clay and sand, this latter predominating. The soil covering the area of Cambrian rocks is made up of the debris of limestone, shale and other rocks of this formation. It is heavier and supports a better growth of trees.

The forest is continuous to between latitudes 52° and 54°, with the exception of the summits of rocky hills. To the northward of latitude 53°, the size and number of barren areas increase rapidly. In latitude 55°, more than half the surface is treeless.

The black spruce, Picea Nigra, is the most abundant tree and constitutes 90 per cent. of the forest. On the southern water shed, the growth is very thick, so that the trees rarely reach a large size. To the northward the trees are more in open glades, where they spread out with large branches resembling the white spruce.

White spruce, Picea Alba, is found throughout the wooded area of the pensinsula. Along the Koksoak River, between Eaton canon and the forks of the Still Water, trees 18 inches in diameter and fifty feet high were seen. About Hamilton Inlet white spruce is abundant. The other trees which grow in Ungava are canoe birch, aspen, balsam, poplar, cedar, banksian pine, tamarack, but none of these attain large diameters.

Fisheries.

According to Low, the numerous large lakes of the several water-sheds and most of the rivers, especially those flowing north and east, are stocked with an inexhastible supply of food fishes of large size and superior quality, including, among other species, the lake and brook trout, land-locked and sea-run salmon, whitefish, pike, pickerel and ling or fresh-water cod.

Very little is known officially or otherwise, concerning the fisheries of that great inland sea, Hudson Bay, and a great amount of wealth may be lying dormant in its waters, from lack of knowledge concerning its fisheries.

Economic Minerals.

Gold.—In his report, Low mentions that he did not actually observe the presence of gold along the routes followed; but that it may occur in the numerous small quartz veins which cut Huronian rocks carrying iron and copper pyrites, when close to the eruptive masses penetrating this formation. The shales of the Keweenawan formation are also cut by numerous quartz veins, often highly mineralized. Circumstances and time did not permit Dr. Low of doing any systematic panning of gravels in these areas.

Since then rumors have been current that extensive rich placer ground has been observed in the region of the head-waters of the Koksoak and Hamilton Rivers. Although there is no confirmation of these reports, such tral gathering ground of the great Labradorean or Laurentian glacier, and, therefore, it was not subjected to such an active glacial erosion as the rest of the surface of the country, and there is more chance of finding occurrences are not unlikely. This region was the cenpre-glacial gravel deposits undisturbed.

Silver.—Dr. Bell, in the report of the Geological Survery, 1877-78, mentions the occurrence of argentiferous galena in a band of magnesian limestone which was traced along the coast from Little Whale River to Richmond Gulf, a distance of 17 miles. At Little Whale River, several years ago, the Hudson's Bay Company made an opening, but work was abandoned.

Iron.—Occurrences of iron ores are numerous, more especially in the rocks of the Cambrian. The ores are associated with a cherty limestone, which is widespread, being met with on the east coast of Hudson Bay, along the Koksoak River and on Hamilton River. However, according to several analyses of samples collected by Low, these iron ores are rather low grade and would require concentrating before smelting.

Besides the above, there are deposits of titanic iron ores in the anorthosite areas; iron pyrites on East Main River, and Wabamisk River; at Shale Chutes; on the Hamilton River and at several other places; anthraxolite on Petitsikapan and Memhek Lakes at the head of Hamilton River; mica has been observed in large crystals on East Main River; on Lake Winokapan.

Recently, there also have been reported finds of diamonds, said to have been made in the drift of the bank of a river, in some indefinite part of the "North Country." No definite information concerning these finds is available beyond the fact that some eight stones, averaging half a carat, were submitted to the firm of jewellers, Henry Birks & Sons, of Montreal, and were prnounced to be diamonds with a water-worn appearance.

It is interesting to note that a transportation company, "The Hudson Bay Steamship Line," Canadian Express Building, Montreal, is inaugurating a steamship service by "SS. Boethic" between Montreal and Hudson Bay ports. The first sailing will be from Montreal on July 2nd. Additional sailings are intended in August and September. The steamer will call at Port Churchill, Port Nelson and Port Nottaway. Such a service will be a valuable help to explorers and prospectors.

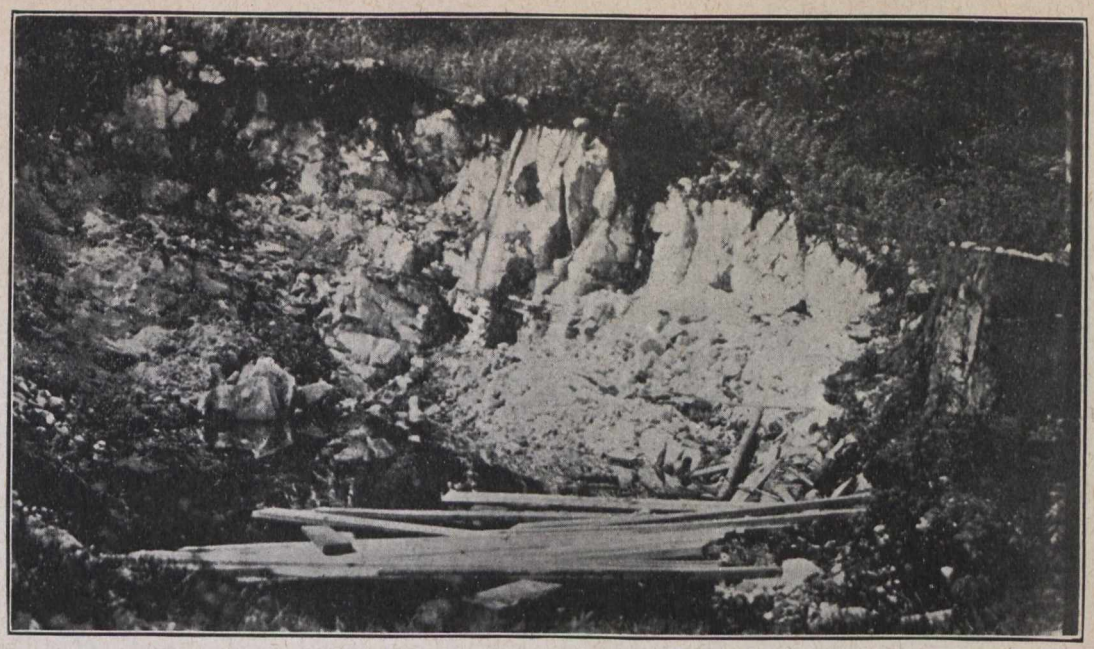
THE MAGNESITE DEPOSITS OF GRENVILLE TOWNSHIP, QUEBEC

By Harold J. Roast, F.C.S.

The magnesite deposits of Eastern Canada differ essentially from other known deposits of the world, in that they appear to have a sedimentary and not igneous origin, and also in the fact that they are crystalline, not amorphous.

At present the chief sources of magnesite are: Greece—in the Island of Euboea-Hungary, California, and Venezuela; while extensive deposits have been found in South Africa, others in Australia and Russia.

In appearance the Canadian magnesite is not unlike coarse-grained marble consisting of pure white translucent crystals capable of taking a high polish.



Magnesite Working, Calumet.

The specific gravity varies from 2.9 to 3.0, eleven cubic feet-making one ton. On calcining the rock the pieces remain intact both as to size and shape, but have an apparent gravity of about 1.4 to 1.5, the actual gravity of the pulverized calcined product is approximately the same as the crude article.

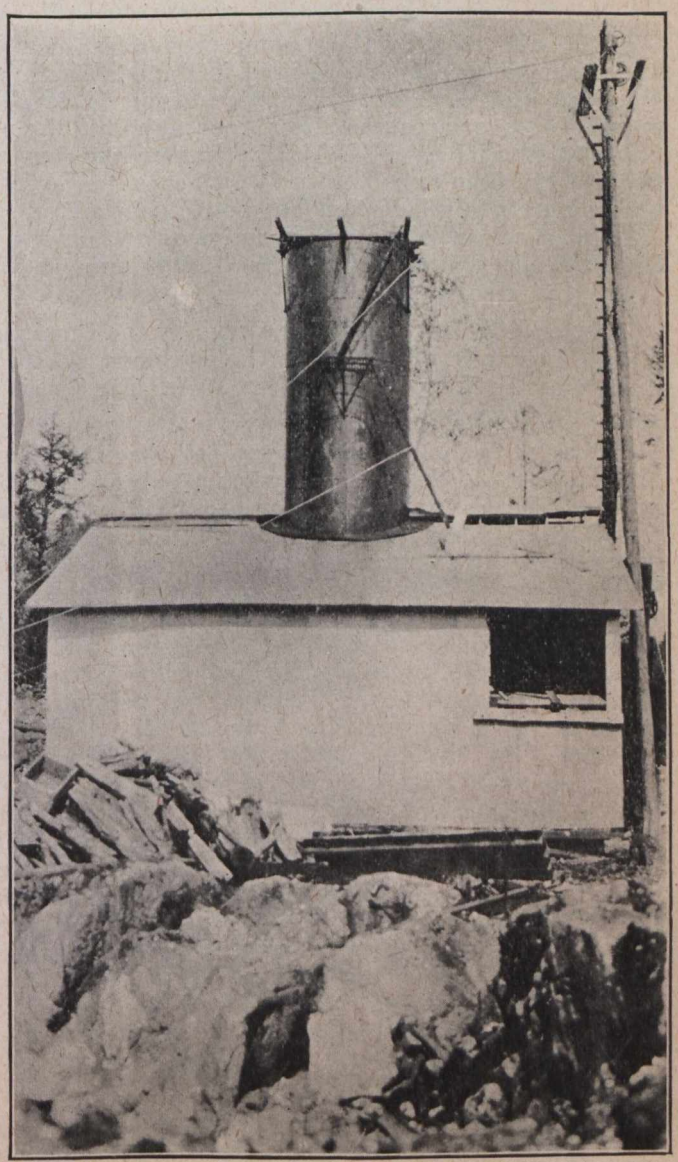
Magnesite is used amongst other things for refractory purposes, such as furnace linings and bricks; for flooring, and in the manufacture of sulphite pulp. In these cases the calcined product is required. For refractory users, the calcining is carried to the point of shrinkage or dead burning. A portion of the carbonic acid gas given off on calcining is used for the manufacture of liquid carbonic acid gas.

Other smaller uses exist, such as the manufacture of Epsom salts and magnesia alba, etc. The only deposits at present being actively worked in Canada, are situated in the Township of Grenville, a few miles north of the Ottawa River. These mines are controlled by the Canadian Magnesite Co., Limited, of Montreal. Considerable work has been done on the property. A large outcropping has been cleared and drill holes sunk to a considerable depth, showing in all cases a solid deposit of magnesite. The results obtained by such prospecting have justified the erection of a kiln. This kiln is now in operation. The rock is mined out on the open quarry system, being picked up by a grab bucket on to an aerial cableway and hoisted to the top of the kiln and dumped automatically therein. The kiln works on the principle of a lime kiln, fired with wood, the calcined product of a lime kiln, fired with wood which carry it either to the storage bins or direct to the pulverizing plant. The calcined magnesite is finely ground and packed into barrels ready for shipment. A large quantity of crude rock is also shipped for use in the manufacture of carbonic acid gas.

The company has erected substantial buildings for the men and horses, also a well equipped blacksmith's shop and hoisting house.

There is a suitable laboratory, where regular and systematic testing of the various products is undertaken.

Along with the question of mining, the company is pursuing a thorough system of prospecting, the idea



The Kiln at Calumet, Canadian Magnesite Co.

being to map out the whole property as to quality of the rock in order that material of any desired composition may be mined when required.

Other deposits have been worked to a small extent by the company which show the presence of very good material, but only one calcining unit has at present been erected. The property is well wooded, so that all heavy lumber required for the various buildings is to be found in situ, as well as a plenteous supply of fuel. A supply of good water is assured by the lake adjacent to the kiln. Owing to the small amount of surface dirt on the deposit, mining can be conducted very cheaply. All the material shipped is carefully analyzed and graded in order to ensure a uniform product to each customer. Some difficulty has been experienced in the discrepancies occurring between various analysts as to the lime and magnesia contents of the calcined magnesite. A standard method has now, however, been worked out by which very concordant and speedy results are obtained. Both lime and magnesia can be estimated within three hours of receiving the sample, the lime determination alone taking half an hour.

The composition of the rock as ascertained by the laboratory of Dr. Donald, Montreal, is:

Silica	2.00 per cent.
Iron and alumina	1.00 "
Lime	9.00 "
Magnesia	40.00 "
Carbonic acid gas	47.50 "
Water (combination)	0.50 "

By a special method of treatment, this rock is made to give equally good results with the Grecian article.

A considerable market has already been found for the calcined material both in Canada and the United States.

The material has also been well received in Europe and arrangements are being made for regular shipments thereto.

All the present indications point to a growing demand for Canadian magnesite and a rapidly increasing development of the deposits and of the uses to which the product can be put.

THE MARBLE INDUSTRY IN QUEBEC

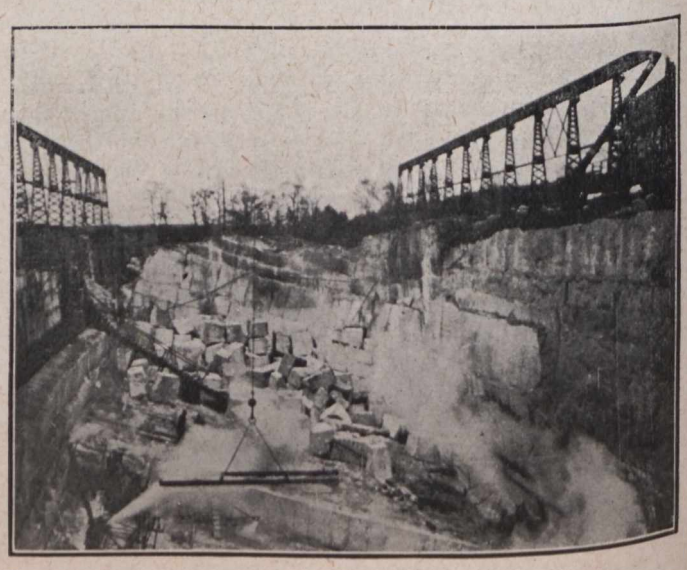
Until quite recently the greater part of the marble and other ornamental stone used in Canada has been imported, and there has been little attempt to develop or utilize our own valuable resources, although the occurrence of marbles of fine quality in both Quebec and Ontario has been long known. In Quebec, however, a beginning in this direction has been made and there are now two marble quarries in active operation, one at South Stukely and the other at Philipsburg, in the County of Missisquoi.

The South Stukely quarry is owned by the Dominion Marble Company, of Montreal. The marble is of superb quality and extremely decorative. The quantity, it is affirmed, is practically unlimited.

The stone is dense and fine grained, having a very low ratio of absorption and taking a high durable polish. The ground mass is of a creamy white, and this is mottled and varied with a variety of tints, the prevailing colors, however, being violet and green. The violet shades off into mauve and purple, with the nicer tints of the grape and the plum. The greens range through sap green to oxide of chrominum and terre verte. This coloring is limited to bold veinings and crowdings, the cream white largely prevailing. It is, therefore, of a light marble pronouncedly decorative in effect. The foreign marbles that suggest themselves for comparison are Fleur de Pecher, Breche Violette, Breche Stazzema and Pavonezza. All these, however, from the Carrava region, are brecciated marbles. The South Stukely marble is not a breccia, but a dense, solid formation with the coloring matter an integral part of the ground mass. This means a graceful flowing pattern and a natural blending of colors, rather than the almost artificial building up of broken fragments characteristic of a becciated structure.

The quarry is situated about a mile and a half from South Stukely station on the Canadian Pacific Railway. The opening is on a side hill and is very convenient for operation. The present equipment consists of three channeling machines, but a number of additional ones will be installed at once, as soon as the development work permits. The unusual soundness of the deposit for a colored marble must strike every visitor. Merchantable blocks were taken from the first floor. On the second floor there is scarcely a seam to be found, while from the third floor, now being cut, it will be possible to take blocks of any size.

The analyses and tests that have been made show that the marble is of great purity and strength. The carbonate of lime runs to 90.58 per cent., and the magnesia 6.91 per cent. The silica is only 1.18 per cent.; oxide of iron, 39 per cent., and alumina .98 per cent. A three-inch cube withstood a pressure of 134,000 pounds, equivalent to a resistance to compression of 14,440 pounds per square inch. The Canadian Inspection Company, Limited, of Montreal, which made the analyses and tests, adds to its report this opinion: "We would judge that it would not be only a very suitable marble for interior wainscoting, etc., but could also be



View of Missisquoi Marble Quarry

used externally where it would be exposed to the weather."

The Dominion Marble Company, Limited, has completed a fine modern sawing mill and finishing plant at Cote St. Paul, one of the suburbs of Montreal. A most convenient site has been chosen. It is directly conected by siding with both the Grand Trunk and Canadian Paciific railways and an electric tram line, that carries freight runs right by the door. The mill is a substantial, fireproof structure of brick. It is run with electric power, not generated on the ground, but obtained from one of the big power companies. There is also a complete and powerful steam plant installed that can be used if desired. The stone-working equipment is furnished by the Lincoln Iron Works, of Rutland, Vt., and consists of six gangs of saws from 9 to 12 feet; three rubbing beds, two of 12 feet and one of 14 feet; three Jenny Lind polishing machines; two large blocking machines; two carborundum machines, one large and one small; two lathes and a planer. The plant is so arranged that additional equipment can be installed without trouble as it may be desired. A powerful air compressor is provided for the operation of pneumatic tools. The blocks of stone are handled by a 25-ton travelling crane of 50 ft. span, 24 ft. lift, and 150 ft. run.

The fine quality of this marble has been already recognized by Canadian architects, and it is satisfactory

Lime Kiln in process of construction at Missisquoi Marble Quarry

to learn that it is to be employed in the interior decoration of a number of important metropolitan buildings now in course of construction, not only in Montreal, but in Toronto, Winnipeg, and other cities even more distant. The marble in the recently completed Chateau Laurier, at Ottawa,—probably the finest hotel in Canada—is also from the South Stukely quarries. The Missisquoi Marble Co. has the distinction of being the first enterprise of its kind in Canada. It was established in 1907 in a small way, but now employs 200 men. This marble has been used in the interior decoration of the new Central Station at Ottawa, in the Transportation Building at Montreal, in the Union Station at Winnipeg, and in the Parliament Buildings, now in course of erection at Edmonton.

Dominion Marble Quarry, South Stukely, Quebec

The mill is equipped with eighteen gang saws, and in the adjoining finishing shop are four rubbing beds, polishing beds, etc. Crushed marble from this quarry is also supplied for "terrazzo" flowing, while the quarry waste is to be converted into carbonate of lime.

QUEBEC BUREAU OF MINES.

Excellent work has been done by the Quebec Bureau of Mines, since the appointment of Mr. Theo. C. Denis to the superintendency in 1910. Mr. Denis, it is but fair to state, has been given every facility in the conduct of the Department, and in undertaking the special work that he has initiated during the past years, as a result of the confidence placed in him by the Minister of Mines, the Hon. C. R. Devlin, who has done more than any of his predecessors in office to promote the welfare of the industry in the Province.

During the summer of 1911, two field-parties were sent out by the Bureau. One of these, in charge of Dr. J. A. Bancroft, Professor of Geology at McGill University, mapped out the geology of an area south of the National Transcontinental Railway, in the vicinity of Keewagama Lake. Dr. Bancroft paid particular attention to the district of Keekeek and Wabaskus Lakes, where reported discoveries of gold caused an influx of prospectors last spring. Dr. Bancroft will continue this same work to the east of the map sheet which he covered last year, and a fuller and more detailed report, embodying the results of the two seasons' work will be issued by the Department in due course.

Another party, in charge of Prof. E. Delieux, of L'Ecole Polytechnique, of Montreal, began an investi-

gation of the iron resources of the Province of Quebec, with special reference to the deposits of titaniferous ores, of which very extensive occurrences are known in several localities.

During the summer Professor Dulieux investigated the iron sands of the north shore of the lower St. Lawrence. These investigations will be continued this year.

Last autumn Mr. J. H. Valiquette visited the quarries in and near Montreal and surroundings.

The permanent technical staff of the Mine Branch is as yet very small, consisting of the Superintendent of Mines and one assistant, Mr. J. H. Valiquette. As the latter accompanied Dr. Bancroft's party during the whole of the field campaign, and, moreover, spent some time in Montreal, on his return from the field, to help in the working up of the results, and in the preparation of the maps, it devolved upon the Superintendent of Mines to inspect the mines, to investigate several reported mineral finds, to prepare the annual report and see both the French and the English editions through the press; attend to the publication of the reports of the Chibougamau Commission, and of the report on the Geology of Fabre Township; carry on the technical correspondence and answer numerous enquiries on our mineral resources, and to keep in touch in general with the mining industry of the Province. In addition, he was obliged to devote some time in co-operation with the Deputy Minister and the Secretary of the Mines Branch in the settlement of various questions arising from disputes on mining claims, which, in some cases, required investigations in the field. The office of Superintendent cannot, therefore, be regarded as a sinecure.

ELECTRIC SMELTING OF TITANIFEROUS ORES

By Dr. Alfred Stansfield.*

In view of the recent developments in the uses of titanium there is a considerable probability that some of the extensive deposits of titaniferous ores in Canada, not to mention the deposits of these ores in Newfoundland which are stated as being "enormous", may in the near future be utilized for the production of pig-iron or steel or for the manufacture of ferro-titanium. The following general statement may be made in this regard:—Ores that are high in titanium, containing perhaps 30% to 35% of titanic acid, are used for the manufacture of ferro-titanium, which is now very widely employed for the improvement of steel and as an addition to iron in the foundry. Inasmuch as the proportion of alloy employed is not very great, this use of titanium, although extensive, only provides for a limited consumption of titaniferous ores, and many of the Canadian ores are too low in titanium to be suitable for this purpose. Titaniferous iron ores are known to be unsuitable for smelting in the iron blast-furnace, mainly on account of the refractory slags which are formed; but the experiments of Dr. Haanel at Sault Ste. Marie have shown that titaniferous ores can be smelted satisfactorily in the electric furnace. It is well known that the iron obtained from such ores is better than iron obtained from non-titaniferous ores.

The possibility of smelting titaniferous or other ores, electrically, depends on the cost of electrical power, charcoal, etc., and the matter can only be definitely determined for any locality, after a careful consideration of many factors. It may be mentioned, however, in this connection, that the figures reported from Sweden with regard to the smelting of magnetite ores at Trollhattan, show that these require about 0.27 electrical horse-power-year and 0.34 ton of charcoal for the production of one ton of pig-iron. These two items might be held in a general way to replace the cost of the coke, or charcoal in ordinary blast furnace practice, and a comparison could therefore be made when the prices of power and charcoal were known. One should consider, however, that, as titaniferous ores are unsuitable for the blast furnace, they would command a lower price, and this would be an argument in favor of their treatment in the electric furnace; moreover the pig-iron obtained from such a furnace would be better, in certain respects, than pig-iron obtained from a coke blast-furnace.

Although the possibility of the electric smelting of iron ores for pig-iron cannot be definitely settled in a general way, there appears to be every probability that a process which yields steel instead of pig-iron would be commercially possible in favourable localities. Steel could be made by smelting titaniferous iron ores in an electric furnace with a somewhat smaller amount of charcoal than would be needed for making pig-iron, and the resulting metal could be transferred in the molten condition to an electrical steel-refining furnace where it could be made into finished steel. The cost of producing the crude steel from the ore would be little more than that of producing pig-iron, and the cost of refining the steel would be only a moderate addition to this; while the price obtainable for the finished product would be decidely higher than could be obtained for pig-iron.

The writer has been associated with Mr. J. W. Evans in the development of a process in which the reduction of titaniferous ores to metal, and the subsequent refining of the steel, is carried out in a single furnace, and while the details of the furnace construction and certain parts of the operation have not yet been fully worked out, the results have been so encouraging that it appears to be worth while to develop the process on a small working scale. With regard to the results so far obtained it may be stated that titaniferous ores obtained from the Orton mine, and containing about 7 per cent. of titanium, have been smelted directly to steel, and that such steel, containing about 1 per cent. of carbon, has been found to possess unusually good qualities as a tool steel. The cost of smelting these ores, and refining the steel, can be determined fairly accurately from the figures published in regard to the electrical smelting of iron ores to pig-iron and the electrical refining of molten steel. These figures are more dependable than data obtained from the small scale experiments that have so far been made. The writer intends, however, in the near future, to make further experiments on the reduction and refining of the steel in order to obtain direct information as to the cost of the process.

*Professor of Metallurgy, McGill University, Montreal.

In regard to the refining of steel obtained in this manner, it may be pointed out that in ordinary steel making, the blast furnace serves to remove the sulphur contained in the ore and fuel, and that the phosphorus, when present in the ore, is removed in the steel furnace with the aid of a limey slag. In the direct process for making steel the removal of phosphorus and sulphur is effected in a different order. The phosphorus is removed in part during the smelting of the ore, because the slag retains some oxide of iron. Very little sulphur is removed during this process, but in the final stage it is easily removed by means of a limey slag in the strongly reducing conditions of the electric furnace. In making steel it will probably be desirable to use specially pure varieties of fuel, such as charcoal, in preference to coke, and whenever possible, ores low in phosphorus. Both sulphur and phosphorus can be removed very perfectly by this process, but the removal of a considerable amount of phosphorus will probably entail the loss of the titanium, and, therefore, in the treatment of phosphoric ores we cannot expect any special advantage from the titanium in the ore, although such ores can, of course, be employed as well as any other ores for steel making.

There does not appear to be any definite limit, as regards the percentage of titanium, in ores suitable for this process; but the cost of smelting will, of course, increase with the proportion of titanium, both on account of the cost of fluxing it and on account of the smaller proportion of steel obtained. It seems probable, therefore, that the process will be applied to ores that do not contain more than 5 to 10 per cent. of titanium. Ores somewhat richer than this in titanium may be concentrated magnetically so as to obtain a product which shall be at once richer in iron and poorer in titanium, and it may even be possible in some cases that the tailings, from such a concentration process may be sufficiently rich in titanium to be smelted for ferro-titanium. Some ores, containing too much titanium for steel making, are not amenable to magnetic concentration, and these may be smelted with suitable admixture of non-titaniferous ores. It has been found that the electric furnace is more suitable than the blast-furnace for the treatment of pulverized ores, and that magnetic concentrates can be smelted alone or with the addition of a moderate proportion of coarser ore.

The use of titaniferous ores for making tool-steel would appear to be very advantageous commercially, but cannot be expected to provide for a large consumption of these ores, and it is of interest to consider whether the process can be applied to the production of steel on a larger scale. One purpose for which this process would appear to be very suitable is the production of steel castings. A good deal of difficulty is experienced in the production of steel castings which can be relied upon as being entirely sound, and ferro-titanium is used in some cases for producing soundness in steel castings It seems very probable, therefore, that steel made directly from titaniferous ores will be particularly suitable for the production of steel castings, and this will afford a larger field for the electric smelting of these ores. With regard to the use of this process on a still larger scale, for the production of steel rails for example, the writer would say that there appears to be no definite reason why rails should not be made by this process, but would not care to speak definitely with regard to this, until the process has been in operation on a working scale.

There are, of course, in a new process many points of difficulty which will have to be overcome, such for example as the consumption of electrodes which will, no doubt, be somewhat larger than in the smelting of ore to pig-iron. The lining of the furnace will also be liable to be more rapidly corroded because the slag will be richer in iron oxide. These and other difficulties have been carefully borne in mind and the writer is hopeful that they will be overcome in the course of the development of the process and that a very important industry will be founded on the titaniferous ores of Canada.

RARE AND RADIUM-CONTAINING MINERALS IN QUEBEC.

By J. Obalski.

In the rocks of Laurentian age, widely distributed through the northern portions of the Provinces of Quebec and Ontario, are to be found many of the rarer earths and minerals, possibly in quantities that would repay research and exploitation. The metals derived from these minerals have a limited economic application, but frequently possess a considerable market value.

Occurrences so far noted in Quebec have been found in pegmatite dykes, which have been worked as producers of white mica in the Laurentian granite and gneiss. The composition of the dykes is muscovite, feldspar (usually orthoclase), quartz, garnets, beryl, turmaline in well formed crystals, magnetite and titanic iron in minute fragments or crystals, and various other minerals from which the rarer metals are obtained.

The several localities in which the rarer minerals have been found are:

Villeuve Mine, Labelle County: Beryl (a silicate of alumina) and glucinium, carrying from 12 to 15 per cent. glucinum oxide. Monazite, phosphate of cerium, lanthanum and didyminum usually containing a percentage of thorium in the form of silicate. Uraninite, oxide of uranium. From this mineral radium is mainly derived.

Maisonneuve Mine, Berthier County: Beryl; Tamarskite (Tantalo-niobate of uranium, iron and yttrium) radio-active. Fergusonite (tantaloniobate of yttrium) and cerium, with zirconium. The minerals occur in relatively large quantities at the Maisonneuve mine.

Pieds des Mont mine, Charlevoix County: Clevite (uranium oxide comparatively high in radium).

Garnets of a fine quality are also found in this mine. The stones have been successfully cut.

Mine in Taché Tp., Lake St. John County: Gadolinite (silicate of yttrium, lantharium, iron and glucinium), with metals of the yttrium and lanthanum groups.

Allanite (a silicate of cerium and yttrium).

Leduc Mine, Ottawa, County: Here has been found a variety of lepidolite or lithium mica; as well as fine specimens of both green and pink tourmaline.

Mine in Duhamel Township, Labelle County: Monazite, in association with thorium in small quantity.

In addition to the Muscovite mines enumerated there are numerous others in the Province that have not been investigated to determine the occurrence of rare minerals. Such investigation might well prove profitable.

Detailed reference to the occurrences will be found in the reports of the Quebec Department of Mines, and

in those of the Geological Survey of Canada. while attention is, in particular, directed to the Quebec reports on Mica published in 1901, and on Mining Operations published in 1905, and to the more recent report on Mica published by the Mines Branch of the Dominion Department of Mines. Valuable information on the subject of the rare metals will also be found in the Mineral Industry for 1902 (McGraw-Hill Pub. Co., New York).

As is generally known Thorium and Zirconium are now employed in the manufacture of mantels, etc., for incandescent lighting; tantalum, among other uses, in the manufacture of electric lamp filaments, and Uranium has valuable chemical properties.

Although the rarer minerals usually occur only in small quantities in the localities mentioned, their recovery, as a bye-product, may readily prove remunerative. At the Maisonneuve mine, for example, Samarskité occurs abundantly and should be well worth saving. Further, those now engaged in mining white mica would be well advised to note the occurrence of minerals of unfamiliar appearance and provide for their identification.

THE TITANIFEROUS ORES AND THE MAGNETIC SANDS ON THE NORTH SHORE OF THE ST. LAWRENCE

By E. Dulieux, Professor of Mining, L'Ecole Polytecnique, Montreal.

On Seven Islands Bay, on the north shore of the St. Lawrence, situated some three hundred miles from Quebec, is an active little settlement, at which the Hudson's Bay Company and Revillon Freres have established trading posts. Here a pier is now under construction—a convenience that will be appreciated by steamer passengers who heretofore have been obliged to avail themselves of friendly boats to effect a landing. Across the bay is a whale factory, and a short line of rail leading to pulp works.

Titaniferous Ores.

Reference to the occurrence of titanic iron ores in this neighborhood will be found in various official reports, and Sterry Hunt (Report of Progress, Can. Geol. Surv., 1866-69), Ecls. (1888-89 Rep. Geol. Surv.) and Obalski have presented more or less detailed descriptions of the ore bodies on the Rapid River, emptying into Seven Islands Bay.

The rocky shores of the bay and the shores of the Rapid River are occupied by anorthosites and gabbros. In several places along the river, the gabbro is so heavily mineralized with titanomagnetite particles, that the rock itself has the appearance of ore. The color is black, the grain is fine, the density is heavy and after minute pulverization small particles of a slightly magnetic matter can be lifted with the magnet. But by a more careful study it is easy to observe that this so-called ore is generally too low in either iron or titanium to have any commercial value. For example, two magnectic gabbros analyze as follows:

$Si\ O_2$	14.60	11.78
$Fe\ O$	20.36	33.18
$Ti\ O_2$	9.40	18.62
$Al_2 O_3$	12.13	8.29

On the other hand in some places, a true segregation of titanic iron ore appears in the anorthosite. The larger, which constitutes the ore bodies described by Hunt and Oblaski outcrops on both sides of the Rapid River, near the second falls, called the chutes du cran de fer. The more extensive outcrop is visible on the steep rocky slopes which rise for 70 feet above the river on the eastern side. It can be followed for 500 or 600 feet along the shore and blocks of pure ore are encountered at an elevation of 50 or 60 feet above the water level. In this deposit every transition is to be found between pure ore containing 50 to 52% of metallic iron and 12 to 15% of titanium and impregnated gabbros containing 10% of metallic iron and 2% titanium. On the other side of the river the same rocks and ores are visible. Here M. M. Molson mined some hundred tons of ore in the early times, part of which output was consigned to the Moisie furnaces.

Other outcrops of a similar ore are frequent along the Rapid River, but for the present none of them seem to be of an equal importance to that described. For the present any estimation of tonnage in sight or probable tonnage is premature. In fact the main point for determination is the economic value of ore of this character. Thus there is no advantage in knowing that there is a large available tonnage if the ore itself is not marketable.

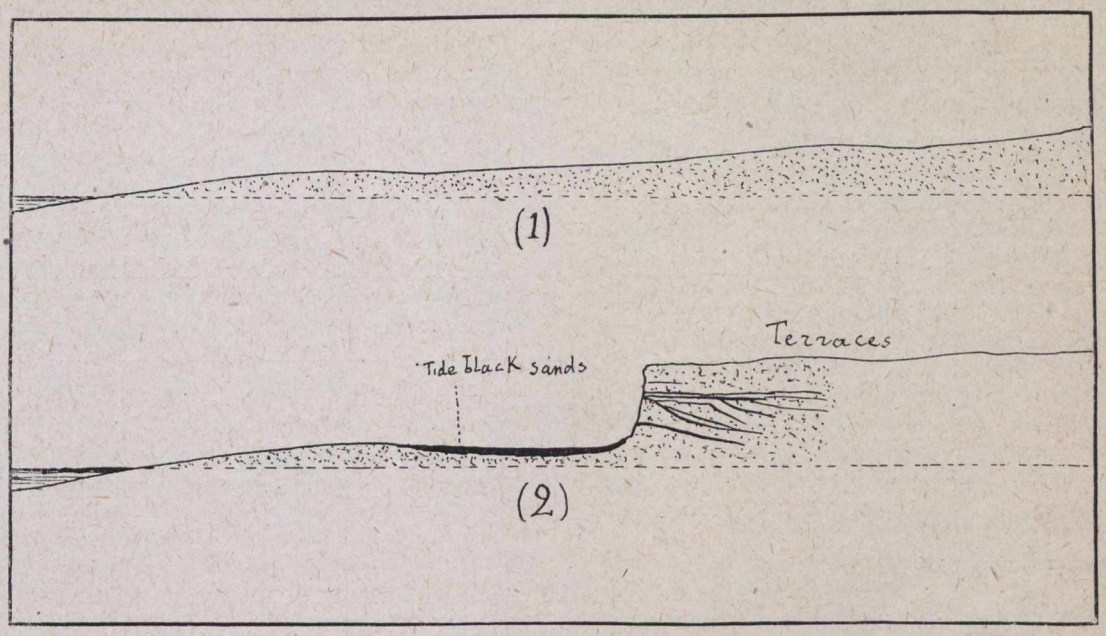
The presence of 10 or even 15% of titanium is not a positive hindrance to the obtention of a good pig iron. In fact the small traces of titanium that are left in the metal are an advantage in the manufacture of steel, therefrom. Ordinarily, titanium would give a refractory slag, but by using suitable fluxes, and by increasing slightly, perhaps, the coke charge, all difficulties disappear. The only real objections to the presence of moderate amounts of titanium in iron ore are that it has the effect of lowering the iron content, and also necessitates a modification in furnace practice. With the gradual exhaustion of high grade iron deposits ores of this character will assuredly in time become valuable. Other similar deposits are found on St. Marguerite River, just above the pulp works and half a mile below the dam. The outcrops are very limited in extent. The ore assays from 50% to 57% iron and from 9 to 12% titanium.

The question of the transportation of these ores presents no particular difficulties. The deposit of the "Grande fer" on the Rapid River could be connected with the Seven Islands pier by an 8-mile railway. From nearby falls from 4000 to 5000 h.p. might be generated.

Magnetic Sands.

From Seven Islands Bay to the Moisie River (20 miles) the coast is a continuous and beautiful sand beach which can be followed for a further nine miles to the east. Along the beach, and more especially on each side of the mouth of the Moisie River are irregular layers of magnetic sand. It is important to distinguish that the two entirely different types of deposits should be recognized:

(1) Tide Sands. On certain places, especially where the waves at high tides have beaten against obstacles, a layer of concentrated sand stretches on the beach. These deposits are the result of a natural concentration process. These layers are from 1 to 30 or 40 feet wide, from 1 to 6 or 10 inches deep, and are traceable with coarse or fine white sand. The discordance of the stratification suggests an estuarine or wavy origin. These layers are relatively narrow; their thickness varies from a fraction of an inch to from 4 to 6 inches. Several drill holes were put down by the author in order to ascertain the average richness of certain terraces



Sketch Showing How the Layers of Tide Black Sands Occur on Beaches at the Foot of the Terraces

for many thousand feet. Their iron content is tolerably high, as is shown by the following analyses:

	Sample. I.		Sample II.	
	Iron.	Titan.	Iron.	Titan.
Raw sand	55.82	8.43	36.42	7.49
Concentrates (by magnet)	68.76	1.80	67.17	1.46
Proportion of concentrates	48%		26%	

(2) Terrace Sands. Several terraces of Champlain age contain seams or layers of black sand intermingled not far from the present beach, and the results showed that for 6 or 8 feet deep the amount of concentrates may run from 4 to, on occasion, 20%, with a possible average of 6 to 7% for several thousand feet along the beach. The concentrates may contain 65% of iron and from 2 to 3% of titanium.

There is probably available a few hundred thousand tons of tidal sand material; the possible quantity of magnetic sands in the terraces could only be determined by systematic investigation, which would envolve several months' work.

SLATE IN QUEBEC.

The known deposits of slate of commercial importance are found in the Eastern Townships, in Richmond, Bagot, Drummond, Shefford and other counties. The slate is both black and "coloured," the former being of Ordovician and the latter of Cambrian age. Quarrying in various localities has been carried on intermittently for nearly half a century, but the industry has never assumed very important proportions; although production in 1889 was valued at $119,161, promising well for that time. Unfortunately, however, this yield constituted a record achievement and since them the industry has persistently declined, while, on the other hand, slate continues to be imported in increasingly large quantities. At present no production is being made, operations at Rocksand being confined entirely to development. It is difficult to understand the reason for this inactivity, more especially as, notwithstanding the competition from the manufacture of other roofing materials, such as terra cotta, asbestos shingles, metal sheets, etc., the consumption of slate in Montreal and other Quebec cities and towns has steadily increased in recent years. The winter conditions in Quebec, of course, to some extent are a serious handicap, not only ncessitating the suspension of work for perhaps six months in the year, but being the cause of much waste. Nevertheless, the proximity of the quareris to excellent markets, the protection afforded the industry by the import duty, and the fact that the local slate is of good quality and colour should afford sufficient inducement and opportunity to quarry-owners here.

Although in 1911 the slate production of the United States showed declination, the value of the output for that year reached the very considerable total of $5,728,-019, of which the quarries in the State of Vermont, adjoining our own province, contributed no less than 28.37 per cent.

QUEBEC MINERAL STATISTICS—RAILWAY SHIPMENTS

We are indebted to Mr. E. O. Grundy, General Freight Agent of the Quebec Central Railway Company, for the following returns of mineral shipments over this time for the year 1911, and for the first five months of 1912:

MINERAL STATEMENT YEAR ENDING DECEMBER 31ST, 1911.

Stations.	Brick.	Lime.	F. Stone.	Copper Ore.	Chrome Ore.
Ascot	29,837,850				
Dudswell Junction		15,547,015			
B. Crossing			211,700		
Weedon				47,985,300	
Coleraine					367,640
Scotts	4,181,650				
St. Victor	276,000				
Total	34,295,500	15,547,015	211,700	47,985,300	367,640
Tons	17,148	7,774	106	23,993	184

ASBESTOS.

Stations.	No. 1. Crude.	No. 2 Crude.	No. 1 Fibre.	No. 3 Fibre.	Asb. Sand.
Black Lake	95,000	797,000	17,660,845	4,367,550	4,668,340
Thetford Mines	3,805,100	5,197,400	55,381,770		50,596,375
Robertson				6,097,220	4,503,725
East Broughton			2,730,850	1,890,050	3,410,140
Total	3,900,100	5,994,400	75,773,465	12,354,820	63,178,580
Tons	1,951	2,996	37,886	6,178	31,589

GRANITE.

Stations.	
St. Sebastian	1,352,550
St. Samuel	103,350
Total	1,455,900
Tons	725

MINERAL SHIPPED DURING FIVE MONTHS ENDING MAY 31ST, 1912.

Stations.	Brick.	Lime.	Copper Ore.	Granite.	Asb. Sand.
Ascot	10,792,636				
Dudswell Junction		6,093,805			
Weedon			15,386,600		
Scotts	1,836,950				
St. Sebastian				450,700	
St. Samuel				80,000	
Total	12,629,586	6,093,805	15,386,600	530,700	
Tons	6,315	3,041	7,693	211	

ASBESTOS.

Stations.	No. 1 Fibre.	No. 3 Fibre.	No. 1 Crude.	No. 2 Crude.	Abs. Sand.
Coleraine	112,000				
Black Lake	11,009,100	1,380,000		60,000	800,100
Thetford Mines	25,634,565		1,293,500	2,273,800	21,578,850
Robertson		160,000			590,000
E. Broughton	258,500	40,000			400,000
Total	37,014,165	1,580,000	1,293,500	2,333,800	23,268,950
Tons	18,501	790	641	1,167	11,634

ASBESTOS MINING IN QUEBEC

The following notes on the principal mines operating in the Eastern Townships are compiled from information obtained by a special representative of **The Canadian Mining Journal,** who visited the districts within the past fortnight. The views of a number of the mine managers on the industrial outlook is also incorporated.

Amalgamated Asbestos Corporation, Limited.

This recently reorganized undertaking is at present operating the King and Beaver mines at Thetford and the British Canadian at Black Lake. The early resumption of operations at the Standard mine, Black Lake, is also contemplated.

The manager, Mr. J. D. Sharpe, is hopeful regarding the future of the industry, affirming that the present demand is steady and the tendency is towards higher prices. The company produced 100,000 tons in 1911. The output this year, it is estimated, will reach 150,000 tons.

The Bell Mines, Limited.

The Bell is the only mine in the asbestos districts in which underground working has been adopted. The underground workings now aggregate over 20,000 feet in asbestos-bearing rock. The capacity of the mill is between 800 and 1,000 tons of rock a day of 24 hours, and the daily output of fibre is approximately 100 tons. The mill is at present working to the limit of its capacity. The fibre and crude produced from this mine represent 6 per cent. of the rock mined, taking also into account dead work and stripping. For stripping, a steam shovel is utilized. The company employs 420 men, whose daily wage ranges from $1.65 to $1.90. The manager, Mr. W. H. Smith, though somewhat noncommittal, appeared to regard the future of the industry as hopeful, remarking that the demand was increasing, and that while as yet there had been no marked increase in prices, the tendency was upward. Shingle stock is, at present, the strong feature.

The Johnson Asbestos Company.

The Johnson mines, at Thetford and Black Lake respectively, afford employment to 300 men, and when worked at full present capacity are capable of producing from 10,000 to 12,000 tons of fibre a year, working 10 hours a day. Mr. Johnson's view of the industrial outlook is somewhat pessimistic. Prices, he points out, have shown no advance, but rather are fluctuating in the vicinity of "low water mark." The demand of late has been good and shipments heavy; but this condition is attributable to buying on the part of manufacturer with a view to accumulating large stocks at prevailing low prices. This will, in Mr. Johnson's opinion, curtail future demand. Prices now are actually from 25 to 50 per cent. below the cost of production and none of the mines are operated profitably. Mr. Johnson also considers that the present milling capacity of the mines of the district far exceeds existing market requirements. The market for asbestos products is, he affirms, very uncertain, for the popularity of such products as yet have not been established. Since, moreover, the uses to which asbestos is put are constantly changing and the distinctive requirements of individual manufacturers must be regarded, no standard of grading is possible. Even when the raw material is required for a purpose such as the manufacture of shingles the quality of fibre that will be required by one manufacturer will not suit the requirements of another, since processes differ. This also applies to paper stock and even to spinning fibre. Thus a manufacturer will ask for a fibre of a particular quality, and the order is filled, the price depending on general market conditions and the quality of product supplied, which may grade from No. 1 crude down. In consequence there is a multiplicity of grades and of prices, ranging from $5.00 to $1.00 per ton, and until there is uniformity in manufacturing processes and manufactured products are standardized, the present condition in this respect will continue.

To illustrate the market uncertainties Mr. Johnson referred to the fact that a few years ago 1,200 tons of asbestos yarn for rope and fabric was manufactured annually in the United States, utilizing for this purpose 1,800 tons of spinning fibre. The trade has since fallen off to 100 tons. Meanwhile a new use for asbestos, promising well, is in the manufacture of automobile brake linings, while fireproof packing is also a new application. Paper stock on the other hand is in less demand than formerly, the best and staple demand being for shingle stock.

The Black Lake Consolidated.

The mill at this property has a daily capacity of 700 tons of rock, and at present produces 35 tons of fibre a day, the rock thus averaging 5 per cent. fibre. Operations were carried on from May to November, inclusive, in 1911, the production during that period being 2,800 tons of fibre. Operations were resumed in April last and improvements and additions to the plant are now being made to increase its capacity. The mine production includes No. 1, 2 and 3 crude; long mill fibre of two grades; paper stock; shingle stock and low grade sands for cement and plaster manufacture.

The Martin-Bennett Asbestos Mines, Limited.

The acquisition of the Ward-Ross property, situated between the Johnson & King mines, for the sum of $710,000, by Mr. Bennett and his associates last year was an encouraging sign as indicating confidence in the future of the industry on the part of skilled and experienced men. The property, as a result of litigation, had been unworked for sixteen years, but it is nevertheless one of the most favourably situated in the Thetford district. The mill, whose capacity is 100 tons of rock an hour, or of approximaely 25,000 tons of fibre per annum, was erected last year and milling operations commenced early this spring. The rock averages about 8 per cent. fibre, and production to date has been 25,000 tons, for which an average price of $40 was obtained.

The Jacobs mine employs 425 men and is working He is our authority for the announcement that a new factory for the manufacture of shingles has been established at Calais, France, which will require raw material to the amount of from 15,000 to 20,000 tons of fibre annually. This plant differs from those producing at present in that it is operated by steam and all grading is done by means of rotary screens and crushing by gyratory crushers. Another statement of interest made by Mr. Bennett was to the effect that grading now in general in the asbestos district is from 25 to 30 per cent. higher than was the case two years ago, all grades being much cleaner and of better quality than formerly.

The Jacobs Asbestos Co.

The Jacobs mine employes 425 men and is working day and night at full capacity. From 1,500 to 1,600 tons of rock, averaging 7 per cent. fibre are treated daily in the mill. The manager, Mr. Walter R. Leventritt, gave our representative the following interesting information on the industrial situation:

In general the market is improving rapidly. The large stocks of crude that accumulates during the late period of depression have been absorbed and in the case of one company only is there any considerable quantity on hand. Stocks of all grades, in fact, have been materially reduced, being 15,000 tons less at present than at the new year. Shipments, however, during the past five months have exceeded all previous records for a like period. In May, shipments from Thetford Station averaged 27 carloads of bagged asbestos fibre daily. From January 1st to June 1st, shipments to Europe represented 260 lots, averaging each 60 tons, whereas in the corresponding period of 1911 the shipments were 158 lots, averaging 50 tons. Prices, Mr. Leventritt stated, have advanced to the extent of 25 per cent. for crude and 10 per cent. for mill fibre. Thus crude selling for $250 in 1911 has now advanced to $300, and No. 2 from $120 to $150 per ton. The production, however, of crude fibre is declining, since the older mines are not recovering so high a percentage of crude as formerly. The annual production of crude is approximately 4,000 tons, 60 per cent. of which is employed in the manufacture of linings for automobile break bands and lighting tanks.

In respect of grading, there is no uniformity of method or of result as between the individual mines. Thus the terms applied to differentiate qualities or grades of fibre are in a measure meaningless, as they signify no recognized standard of quality. Each company, however, produces several different grades under the following general heads:

1. No. 1 crude, 2. No. 2 crude—Some companies make a No. 3 crude, but the output of this grade is small.

3. No. 1 long fibre (used in Europe for spinning), $100 per ton 2,000 lbs.

4. No. 2 long fibre, formerly used for spinning, but not used largely for the manufacture of insulating material and steam packing, $65.00.

5. Long shingle stock, $45.00.

6. Short shingle stock, $27.50.

7. Paper stock (asbestos paper, air-cell steam pipe covering, mill board filling, roofing, etc.), $20.00.

8. Short, low grade for cements, plaster, flooring, etc. $5.00-$10.00.

Manifestly the prices quoted are approximations only, producers accepting orders at any price and then grade the product in keeping with the price; but usually prices are based on specifications requiring that a stated percentage of fibre shall pass through a screen of stated mesh conder agitation at a stated rate for a stated time.

Mr. Leventritt confirmed the statement of others that the demand for paper stock is declining, while that for shingle stock is on the increase, and many of the mines are now catering directly to this trade. For shingles a coarser fibre having more "life" than is necessary for paper-making, is required. There are at present seven shingle factories in Austria, ten in Germany, one in England, one in the United States and one in Canada.

Mr. Leventritt estimates that Canadian production in 1912 (exclusive of sands shipped in bulk) will approximate 110,000 tons, of which Thetford may be expected to contribute 65,000 tons, Danville, 25,000 tons; and the districts of Black Lake, Robertson and East Broughton the difference.

The Asbestos and Asbestic Co., Ltd.

Two mills are in operation at this company's Danville property, on which, also, 600 men are employed. ployed.

East Broughton.

There are in all six plants in the Broughton district, namely, those of Ling, Frontenac, Eastern Townships, Broughton and Montreal companies. None is, however, at present in operation, but negotiations are in progress for the amalgamation of the Ling, Eastern Townships and Frontenac properties. On the latter is erected the finest mill in the district, valued at $250,000, while on the Ling and East Townships are large quantities of asbestos-bearing rock of good milling quality. The Ling was the only mine operated in the Broughton district last year. Its production was 4,457 tons, the rock milled averaging from 8 to 9 per cent. fibre. The grades of mill fibre produced were:

X.—Spinning and extra paper stock, ¾ in. to 1 in. in length, $80.00.

XX.—Paper stock, ½ in. in length, $25.00.

XXX.—Slate and Tile stock, short fibre free from, $9.00.

XXXX.—Short fibre cement, plaster, etc., $5.00.

The asbestos grades about 30 to 35 per cent. XX. grit and dirt, $9.00.
35 to 40 per cent. XXX, and 20 to 25 per cent. XXXX, with a small proportion of X.

The Berlin Asbestos Co. (Rumpelville).

At this company's mine 125 men are employed. The rock mined averages from 7½ to 8 per cent. asbestos. The production at present is 1,000 bags of 100 lbs. each daily. The company has no stocks on hand and is making regular consignments to Germany. Four grades of fibre are produced, namely:—

Hand-picked crude spinning fibre, $85 per ton of 2,000 pounds.

A. Mill fibre, long, 1 in. to 1¼ in., $75 per ton of 2,000 lbs.

B. Paper stock, ½ in. fibre, $19 per ton of 2,000 lbs.

C. Short, for cheap paper, plaster, etc., $6.50 per ton of 2,000 lbs.

Of 500 bags, 10 graded spinning.
28 " A.
200 " B.
262 " Short.

Mr. Walter Rumpel, the manager, expressed the opinion that the market was improving, that stocks were low and that the general outlook was more favourable than for some time past.

The B. & A. Asbestos Co. (Robertsville).

The mine is in full operation an demploys 125 men, and produces 50 tons of asbestos daily. The rock yields 8 per cent. asbestos, but as high as 10 per cent. has been mined. The production of all the property in 1911 was 3,600 short tons, the average value of the output being $27 per ton. In addition to No. 2 Crude, four grades of fibre are produced, as follows: —

F1.—Spinning.

F2.—Paper stock.

F2X.—Slate and shingle stock must be very clean.

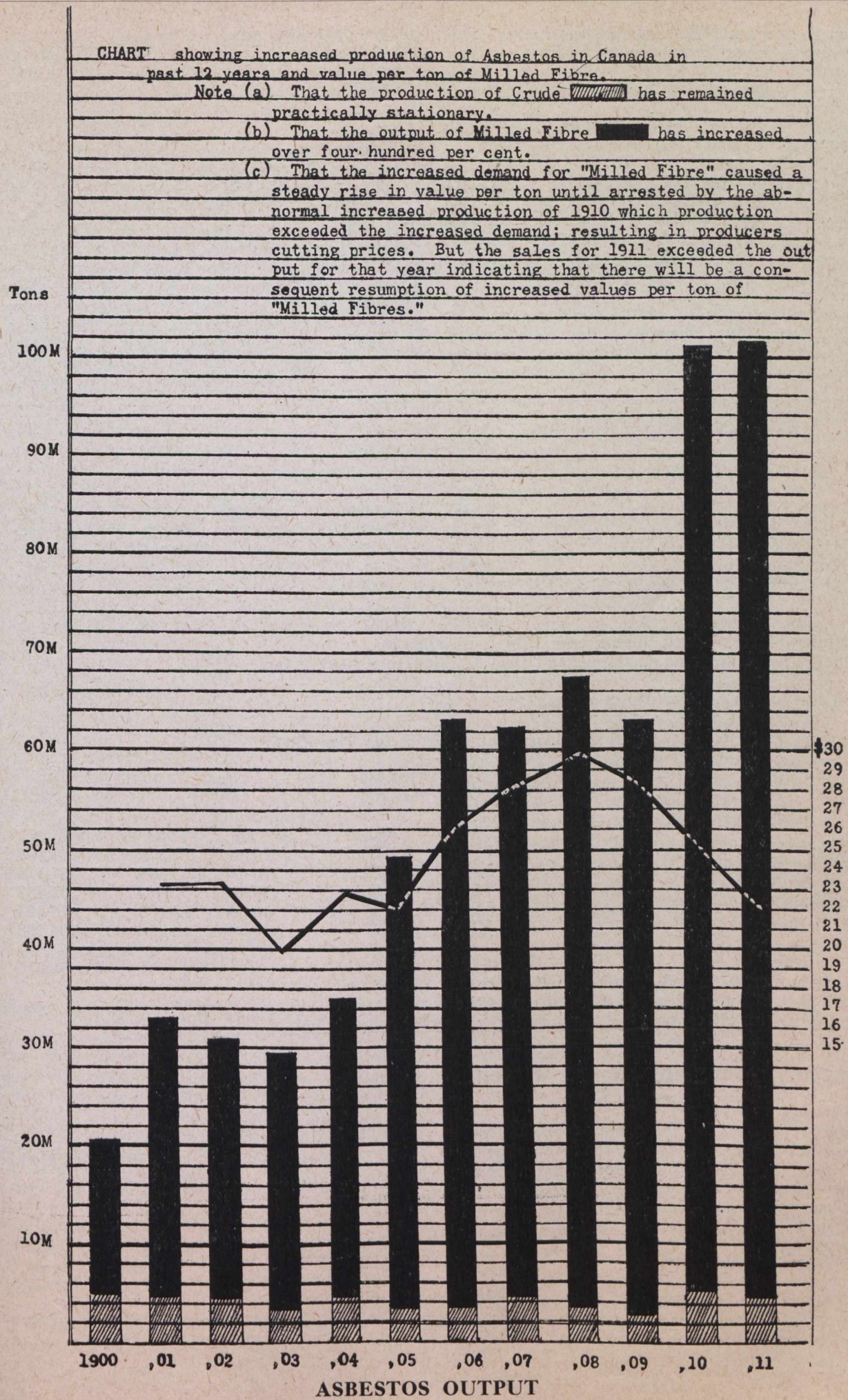


CHART showing increased production of Asbestos in Canada in past 12 years and value per ton of Milled Fibre.
Note (a) That the production of Crude has remained practically stationary.
(b) That the output of Milled Fibre has increased over four hundred per cent.
(c) That the increased demand for "Milled Fibre" caused a steady rise in value per ton until arrested by the abnormal increased production of 1910 which production exceeded the increased demand; resulting in producers cutting prices. But the sales for 1911 exceeded the out put for that year indicating that there will be a consequent resumption of increased values per ton of "Milled Fibres."
Tons
100M
90M
80M
70M
60M
50M
40M
30M
20M
10M
$30
29
28
27
26
25
24
23
22
21
20
19
18
17
16
15
1900
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,11
ASBESTOS OUTPUT

F3.—Short fibre used filler in mill board, etc. None of the lower grades under $5 per ton is saved.

Mills in the District.

The following table shows the number of mills and milling capacity at mines now in active operation:

Company.	No. of Mills Operating.	Men Employed.	Yearly. Capacity Tons.
Berlin Asbestos Co...	1	125	10,000
B. & A. Asbestos Co...	1	125	10,000
Bell Mines	1	420	20,000
Jacobs Asbestos Mining Co.	1	425	20,000
Amalgamated Asbestos Corporation ...	4	800	40,000
Johnson Asbestos Co.	2	300	10,000
Martin-Bennett.	1	220	25,000
Black Lake Consolidated.	1	230	10,000
Asbestos & Abestic Co., Danville	1		25,000
	13	2,645	170,000

Capacity given in tons of fibre produced per year based on daily capacity for yearly run of 200 days.

STATISTICS.

The shipments of asbestos from the various producing centres, Thetford Mines, Black Lake, Danville, East Broughton, all in the Eastern Townships, reached a total of 102,224 tons, valued at $3,026,306, the highest sales yet recorded. This is a substantial increase as compared with the previous year, 1910, when these shipments were 80,605 tons, valued at $2,667,829.

For the purpose of comparison, we give the details of last year's production as well as this year's.

Production of Asbestos for 1910.

	SHIPMENTS. Stocks on hand on Dec. 31, 1910.				
	Tons.	Value.	Value per ton.	Tons.	Value.
Crude No. 1	1,817	$ 471,649	$250.57	1,763	$ 447,227
Crude No. 2	1,612	196,382	121.82	3,181	440,884
Mill Stock No. 1	10,313	627,635	60.88	4,938	313,053
Mill Stock No. 2	44,793	1,141,374	25.48	24,417	612,065
Mill Stock No. 3	22,070	230,789	10.46	6,920	99,694
Totals	80,605	$2,667,829	$ 33.10	41,159	$1,921,923

Quantity of rock mined during year 1910, tons 2,035,705.

Quantity of asbestos as stock on hand Dec. 31, 1909, tons 20,921.*

*Figures of the Federal Mines Branch.

Production of Asbestos for Year 1911.

	SHIPMENTS. Stock on hand.				
	Tons.	Value.	Average value per ton.	Tons.	Values.
Crude No. 1	1,400	$ 388,224	$277.30	1,358	$ 360,304
Crude No. 2	3,382	382,980	113.68	3,368	431,548
Mill Stock No 1	6,340	415,559	65.54	3,794	207,403
Mill Stock No. 2	35,991	1,041,684	30.33	12,272	379,523
Mill Stock No. 3	55,111	747,759	13.57	12,959	204,298
Totals	102,224	$3,026,306	.....	33,751	$1,583,076

Quantity of rock mined during year 1911, tons, 1,759,064.

The whole of the rock mined does not go to the mills. A proportion of about 25 per cent. is considered too poor to be treated economically, and is thrown on the waste dump.

ASBESTOS PRODUCTION OF THE WORLD.

(Exclusive of Canada.)

Unfortunately, statistics of asbestos production in countries other than Canada giving the returns for 1910 and 1911 are not obtainable. The following table, compiled from the report on colonial and foreign statistics of the Home Office, England, presents these returns for 1909, and is of general interest as indicating Canada's pre-eminence in this field:

	Metric Ton.	Value.
Russia.	11,911	£92,180
Cape Colony	1,519	24,922
United States	2,799	12,855
Cyprus.	156	1,407
Rhodesia.	247	2,725
Australia.	3	154
	16,635	£134,243

These quantities are equal to 18,342 short tons, valued at $653,761.

J. S. Diller, in the Mineral Resources of the United States, gives the production of that country during 1910, as 3,693 tons, valued at $68,357.

Rhodesia reports a production of 1,114½ tons valued at £12,904 for 1910.

Unofficial figures for Russia give a production of 15,540 metric tons of asbestos in 1911.

The first report of the Mines Department of the Union of South Africa for seven months ending 31st December, 1910, mentions that asbestos mines have been worked and contributed to the mineral output in Transvaal, Cape Colony and Natal. It is from the Cape, that the principal production comes, 680 tons, valued at £10,598.

No recent statistics are available from Portuguese South Africa concerning asbestos, but a few years ago a substantial shipment of asbestos of high grade was effected.

THE PRESENT CONDITION OF THE ASBESTOS INDUSTRY IN CANADA

By H. Mortimer-Lamb.

As is generally known, over 80 per cent. of the world's consumption of asbestos is derived from the limited area comprising the five districts of Thetford, Black Lake, Broughton, Robertsonville and Danville, in the Eastern Townships of the Province of Quebec.

Asbestos was first discovered at des Plantes River in 1860. This occurrence, however, was not of economic importance, and the real birth-year of the industry was 1877, consequent upon the Thetford and Coleraine discoveries. The history of the industry falls naturally into five distinct stages or periods. The first, from 1877 to 1890, when "crude" (the long-fibre asbestos cobbed out of the rock) was almost exclusively produced. In this stage the output increased from 50 tons produced in 1877 to 9,860 tons in 1900. Towards the close of the period it became recognized that the cost of hand extraction of "crude" alone was excessive, and that unless a more economical method of extracting the lower grade or shorter fibres was devised, the industry would not succeed.

The next period, therefore, between 1890 and 1895, was one of experimentation in and evolution of milling methods for the economical extraction of short fibre. In the interim production decreased. At the close of 1895 a milling practice affording reasonably satisfactory results had been evolved.

The fourth period, from 1909 to the end of 1911, was marked by the exploitation of the industry by the company promoter.

The evolution of the industry is, however, more graphically indicated in the following table and diagrams:

	Crude			Mill Stock				
Year.	Tons.	Value.	Per Ton.	Tons.	Value.	Per Ton.	Total Tons.	Total Value.
1900	....	.....	.....	.....	.....	$	21,408	$719,416
1901	4,743	$612,434	$129.14	28,713	661,881	$23.00	33,456	1,274,315
1902	4,450	545,713	124,08	26,184	616,257	23.00	30,634	1,161,970
1903	3,284	345,766	105.29	25,977	571,204	21.98	29,261	916,970
1904	4,372	517,779	118,43	31,107	669,016	21.50	35,479	1,186,795
1905	3,598	465,110	129.26	45,362	1,001,340	22.29	48,960	1,476,450
1906	3,927	645,735	164.43	58,448	1,497,918	25.62	62,375	2,143,653
1907	4,425	829,761	187.51	57,560	1,626,158	28.73	61,985	2,455,919
1908	3,671	699,521	190.55	61,485	1,852,075	30.12	65,156	2,551,596
1909	3,074	575,510	187.55	60,275	1,709,077	28.35	63,349	2,284,587
1910	5,449	968,046	177.67	94,981	2,435,312	25.64	100,430	3,403,358*
1911	4,863	744,962	158.18	96,029	2,177,100	22.67	100,893	2,922,062†

*Output figures taken.
†Sales figures taken.

An analysis of the above figures shows that the production of the crude material has been maintained at a tolerably uniform rate of in the vicinity of 5,000 tons annually, during the period under review. On the other hand, there has been a notable and steady increase in the production of mill stock. Moreover, with two brief intermissions the price of mill-stock advanced until the maximum average price of approximately $30 a ton was reached in 1908, from which date the price as rapidly declined. The present average price of about $22.50 for mill-stock is in most cases below the actual cost of production. An explanation of these conditions is that there have been no further discoveries of crude, the really high-priced product, admitting of any considerable increased production of asbestos of this grade. In mill stock, prior to 1909, a healthy equilibrium was maintained between production and consumption. In 1909, however, as already mentioned, the promoter saw his opportunity. The result to the industry was disastrous. Heavily over-capitalized companies were launched and to justify the exaggerated estimates of earnings given to the public, a policy of gross overproduction was adopted. This, as will be observed in the chart, resulted in an increased output in 1910 over 30,000 tons of fibre, as compared with the returns of the preceding year. Meanwhile prices had sharply declined, this decline being directly attributable to overproduction and consequent price cutting. The column in the chart for 1911 represents the actual sales during that year, indicating that in spite of the tremendous increase in production the market absorbed the surplus production of 1910, though at a low price. According to the official returns published by the Quebec Government, stocks on hand at the close of 1911 were 33,751 tons, as compared with 41,159 tons in 1910. Thus the balance as between production and shipments is being

gradually readjusted, and the situation in general is much more promising than it has been for some time past. There are, however, certain disturbing factors of which count must be taken. The reorganization of the Amalgamated Asbestos and of the Black Lake Consolidated has just been effected. In the case of the former, the capital and fixed charges have been reduced. The bond issue is now three million dollars instead of five. Since the bonds bear interest at the rate of 5 per cent. the annual charge on this account is now $150,000. According to a statement contained in a circular issued to bondholders by the "General Bondholders Committee" early in the year, the Amalgamated Company's "plant is capable of an annual output of 30,000 tons" and profits are estimated at $8.00 per ton. Assuming these statements to be correct, although the estimated profit is certainly high, the Amalgamated Asbestos Company will still require to tax their production capacity to the utmost in order to make even a very modest return to holders of the preferred and common shares—in fact, at the best, the outlook for the ordinary shareholders is exceedingly dubious. The situation is the same as regards the Black Lake Consolidated. Both undertakings are saddled with an altogether unfair load; neither can afford to curtail production. But either production in the district must be curtailed to not exceed ordinary market requirements, or, at ruling prices, the costs of production will have to be materially reduced if the industry is to survive, much less flourish. As a matter of fact the operators are in a position to control the situation if they could mutually agree to maintain prices at a certain level; but, unfortunately, the likelihood of such an understanding being reached is remote to a degree. Consequently, if over-production and competitive methods envolving price-cutting continue to obtain without regard to economic considerations of supply and demand, it is inevitable that sooner or later the weaker mines will go to the wall; none will profit.

To sum up briefly: The demand for asbestos is not only greater than at any previous time, but this demand is increasing steadily. The supply, however, at the rate of production recently maintained, is considerably in excess of the demand. A fierce competition between producers to secure market preference, has, in consequence, ensued, with the result that prevailing prices for the bulk of the product, namely, mill-fibre, do not admit of a reasonable return on operations. The hopeful feature is that the causes responsible for the present unfavourable conditions are known and can be remedied. Sanely conducted the industry has an excellent future. If the past rate of increased consumption continues, as seems inevitable, the condition should shortly arrive when the mines instead of over-producing will be taxed to meet the demand.

THE TOPOGRAPHICAL DIVISION OF THE GEOLOGICAL SURVEY

By W. H. Boyd.*

Topography is the delineation of the natural and artificial features of a locality. Topographical surveying is the process of accurately determining the relative positions of the natural and artificial features of a locality and representing them on a map. The natural features (drainage and relief) are the lakes, rivers, streams, mountains, hills and undulations of the surface; while the artificial features (culture) are the works of man, such as the towns, railways, roads, trails, etc. The correct relative positions of these features are obtained by some method of survey; the results of these surveys establishes the mathematical base, or control points, of the map; the representation of these features is shown by an accurate sketch of these features between the control points. In other words, a topographical map is a sketch controlled by fixed points (locations). It is evident then that the work connected with the making of a topographical map consists of two parts, namely, that of fixing the locations, which is instrumental, and that of sketching, which is done by the hand and eye. Although the sketching is all that appears on the finished map, yet it is essential and most important to have a correct mathematical base to control the sketching, in order that the map may be a trustworthy one. Briefly stated, the correctness of a map depends on the following: the accuracy of the locations, the number of the locations per square inch of map surface, the distribution of the locations and the quality of the sketching.

The main principle observed in map-making is to work from the whole to the part. No compilation of independent groups of surveys or plans will ever result in a trustworthy map. Observing this principle then, it is first necessary to obtain a primary control of the area; by this are established a few locations of a high degree of accuracy, on which depend all other locations. Between these primary control points is then established the secondary control; by this many locations are made with a lesser degree of accuracy, but yet sufficiently accurate so that other points located from them will be well within the allowable error of location. The maximum allowable error in the location of a point is taken as being 1/100 of an inch of the map scale. Between the primary and secondary control is established the tertiary system of location which embraces all the points necessary for the proper sketching of the culture, drainage and relief over the area.

The methods and instruments employed in fixing the locations vary with the scale of the map, the character of the country, and purposes for which the map is intended. These three factors must be known before undertaking a topographical survey of a country. The contour interval to be used on the map must also be known, as the accuracy with which the elevations for contour points are determined is based on the interval selected, which in turn is governed by the map scale and character of the country.

The following diagram shows all the methods adopted by the Topographical Division, as a standard for obtaining the mathematical control over any map area. This diagram embraces all the methods of mapping used by the division. The methods of mapping are those commonly known as the camera method, the

*This article was secured through the courtesy of the Director, Mr. R. W. Brock.

plane table intersection method, and the traverse method. The complete mapping of an area is not necessarily confined to one method, sometimes two, or all three, of the methods are combined. The combina-

all three of the methods are combined. The combina-

country which is being mapped.

Diagram of Control (Graded.)

Standard Topographical Maps.

Primary.	Horizontal.	1. Triangulation—directions—8 in. theodolite—2 secs. 2. Triangulation—repetition—6 in. transit theo—10 seconds. 3. Traverse—transit 20 or 30 seconds and tape.
	Vertical.	a. Levelling — reading to $\frac{1}{1000}$ foot. b. Zenith distances, reading to 30 seconds.
Secondary.	Horizontal.	4. Triangulation for camera stations—transit to 1 min. 5. Triangulation plane table and telescope alidade. 6. Traverse—transit and micrometer eye piece—transit —30 seconds or 1 minute. 7. Traverse—transit and stadia.
	Vertical.	c. Levelling—ordinary. d. Vertical angles to 1 minute.
Tertiary.	Horizontal.	8. Photograph intersections. 9. Plane table intersections. 10. Plane table and stadia or micrometer eye piece. 11. Compass and telemeter.
	Vertical.	e. Vertical angles to 1 minute. f. Hand levelling.
Filling In.	Horizontal.	12. Plane table, tape, wheel or pace. 13. Compass, tape, wheel or pace. 14. Compass, time or estimation.
	Vertical.	g. Aneroid barometer.

Sketching, Continuous Contours.

Sketching of land forms from photographs.
Sketching of land forms from plane table stations.
Sketching of land forms from traverse lines.

The Standard Topographical Maps are printed in three colours, black, blue and brown. The black is used for the culture, the blue for drainage, and the brown for the contours showing land forms and relief. Conventional signs are employed to facilitate the reading of the map. Each map has a legend showing all the signs that have been used over the whole map.

It is to be hoped that in this country the value of a good topographical map will be more widely recognized, since it is of great practical assistance to engineers and others who are engaged in the work of developing the natural resources of this country.

The topographical mapping done by the Geological Survey before and after the organization of the Topographical Division is given below, also the method the Survey has adopted of classifying all of their maps.

The Topographical Division of the Geological Survey was organized in 1909. The division is small at present, consisting of 1 topographer in charge, 3 junior topographers, a triangulator and computor, and 9 topographic assistants. Since the organization of the division 15 standard maps have been executed; of these 10 are regular sheets, that is, bounded by even degrees, half degrees or quarter degrees of latitude and longitude, depending on the scale $\frac{1}{250000}$, $\frac{1}{125000}$ and $\frac{1}{62500}$ respectively. The 15 sheets above mentioned cover a total land area of approximately 4,800 square miles and vary in scale from 400 ft. to 1 inch to $\frac{1}{250000}$ or approximately 4 miles to 1 inch, with contour intervals of 20, 100, and 200 ft.

The Geological Survey has altogether completed 53 topographical maps which cover a land area of approximately 60,239 square miles, the scale ranging from 400 ft. to 1 inch to 8 miles to 1 inch with contour intervals varying from 20 ft. to 1,000 ft. Thirty-nine of these maps were completed since 1905, covering a total land area of approximately 15,741 square miles.

Topographical Mapping Done by Geological Survey From 1905 to 1911.

Map District.	Scale.	Contour Interval.	Approx. Land Area in Sq. Miles.
1905.			
*Rossland	400 ft. to 1 in.	20	2
Elk River	2 miles to 1 in.	200	230
1906.			
*Rossland	1,200 ft. to 1 in.	40	7.5
Costigan Coal Basin (started).			
Telkwa River	2 miles to 1 in.	250	400
Conrad	2 miles to 1 in.	250	640
Princeton Coal Basin	½ mile to 1 in.	100	90
Bonanza and Hunker Creeks	½ mile to 1 in.	50	165
1907.			
Lardeau (completed)	4 miles to 1 in.	500	1400
Costigan Coal Basin (completed)	1 mile	100	450
Hedley	1000 ft. to 1 in.	100	16
Whitehorse	1 mile to 1 in.	50	112
1808.			
*Phoenix	400 ft. to 1 in.	20	2
Bathurst (started)			
Bulkley Valley (started).			
Bighorn	2 miles	200	340
Tulameen	1 mile	100	170
Braeburn-Kynocks	2 miles	250	390
Tantalus	2 miles	250	400
1909.			
Topographic Division Organized.			
Wheaton	1 mile	100	170
Bathurst (completed)	1 mile	20	310
Bulkley Valley (continued).			
Slocan (started).			
Beaverdell (started).			
*Saanich Sheet	1 mile.	20	78
*Victoria Sheet	1 mile	20	52
Nipisiguit Iron Deposit	400 ft. to 1 in.	20	0.5
1910.			
*Deadwood	400 ft. to 1 in.	20	0.5
*Sooke Sheet	2 miles to 1 in.	200	230
*Duncan Sheet	2 miles to 1 in.	200	375
*Nanaimo Sheet	1 mile to 1 in.	20	140
*Orillia Sheet	1 mile to 1 in.	20	150
Atlin	2 miles to 1 in.	200	525
Jasper Park	1 mile to 1 in.	100	53
Tobique	2 miles to 1 in.	40	440
Bulkley Valley (completed)	4 miles to 1 in.	250	4800
Portland Canal	2 miles to 1 in.	200	80
1911.			
*Slocan (completed)	1 mile to 1 in.	100	270
*Cowichan Sheet	4 miles to 1 in.	200	1370
*Alberni Sheet	4 miles to 1 in.	200	1335
*Moncton	1 mile to 1 in.	20	230
*Frank Landslide	800 ft. to 1 in.	20	3.5
*Balsam Lake Sheet	1 mile to 1 in.	20	180
*Mud Lake Sheet	1 mile to 1 in.	20	200
*Blairmore (started)	1 mile to 1 inch	100	194 (64 completed)
Jasper Park (continued).			

Total, 39 maps. Total, 15,741 square miles.

Topographical Work by Geological Survey Previous to 1905.

British Columbia.			
Caribou	2 miles to 1 in.	250	2180
Crow's Nest	2 miles to 1 in.	500	500
Boundary Mining District	1 mile to 1 in.	100	215
West Kootenay	4 miles to 1 in.	500	5920
Yellowhead Pass	8 miles to 1 in.	1000	1920
Atlin	4 miles to 1 in.	500	3580
Kamloops	4 miles to 1 in.	500	6400

*Rated as G. S, C. Standard maps.

Shuswap	4 miles to 1 in...	500	6400
Trail	1 mile to 1 in....	100	210
East Kootenay	4 miles to 1 in...	500	2900
Manitoba.			
Turtle Mountain	1½ miles to 1 in.	25	495
Northwest Manitoba	8 miles to 1 in...	100	12672
Yukon.			
Klondike	2 miles to 1 in...	100	1064
Ontario.			
Silver Mountain Mining District	4-inch=1 mile ..	25	42
Total			44,498

Total, 14 maps Grand total, 60,239 square miles.

Classification of Maps.

As the Geological Survey issues so many maps other than their standard class, it was considered advisable to classify them with relation to their degree of accuracy and to use a concrete expression on the map so that the general public would be made acquainted with the fact that a definite system of map classification was used by the Geological Survey, thereby guiding them, in a general way, in the usage of such maps. The following is the scheme adopted:

1. The mapping of the Geological Survey is divided into five classes, namely:

Class A.—Maps, topographical.
Class B.—Maps, geographical.
Class C.—Route maps.
Class D.—Plans.
Class E.—Diagrams.

Any of these may be used as a base for geology.

2. The word "topography" is applied in its true ense as the delineation of the natural and artificial features of a locality,—this class essentially shows "relief."

3. The word 'geography" is applied to a map the area of which has been surveyed or compiled from various data, but which does not show "relief."

The word "geography" is applied to a map the area of which is surveyed or compiled from various data and which shows "relief," but the representation of which is not of the character or quality demanded by the class which carries the name of "topography."

4. The word "plan" is applied to the representation, without showing "relief," of an area given on plan scale; the expression "plan scale" is considered to embrace scales of say, 1,200 feet to an inch, and larger; a plan would necessarily require plan accuracy, otherwise it would fall into the "diagram" class. In the title of a plan, the wording "plan of" would be included.

5. The word "diagram" is applied in its true meaning to drawings, coloured or uncoloured, which have been prepared to illustrate statements, or to facilitate, in a general way, the broad understanding of a subject; under no consideration will the accuracy of the material from which a diagram is prepared, influence the raising of such an illustration into the map or plan classification.

6. The grading or classification is only used in the treatment of topographical or geographical maps, and not with plans or diagrams.

7. The standard in topography or geography is that of the Geological Survey; this standard, it is believed, will compare favourably with that of other countries.

8. In the classification of maps, whether topographical or geographical, there are three distinct groupings, namely:

Group 1. Standard maps.
Group 2. Graded maps.
Group 3. Inferior maps.

In the case of "standard" maps, no statement as to their accuracy would be given to the general public, they standing on their own merits according to the branch of mapping which they represent being accurate to scale throughout; "standard" maps, therefore, would be of a somewhat limited number at the present time.

By accepting this basis of standardization, it follows that the large proportion of maps would fall into the "graded" group, which affords scope for the classification of maps not attaining the "standard" group, nor descending into the "inferior."

The "inferior" group would comprise maps of very little topographical or geographical value, but useful as guides or illustrations.

9. Wording of classification to be printed on graded maps (group 2).

Class A.	**Class B.**
Topography rated grade 2.	Geography rated grade 2.
Topography rated grade 3.	Geography rated grade 3.
Topography rated grade 4.	Geography rated grade 4.

Class C. Route maps, rated grade 1. Rated grade 11. In the case of Class A. the word "detail" may be used as an adjunct to qualify topography.

Example:

Detail Topography
rated grade 2.

10. Wording of classification to be printed on maps of the inferior group (group 3).

Class A.	**Class B.**
Topography, inferior.	Geography, inferior.

11. Wording of classification to be printed on graded maps when they form the base for geology, forestry, etc.

Class A.	**Class B.**
Topographical base, rated grade 2.	Geographical base, rated grade 2.
Topographical base, rated grade 3.	Geographical base, rated grade 3.
Topographical base, rated grade 4.	Geographical base, rated grade 4.

12. Wording of classification to be printed on maps of the inferior group, when they form the base for geological colouring.

Class A.	Class B.
Topographical base, inferior.	Geographical base, inferior.

13. The above-mentioned decisions in no way supersede the present practice of qualifying, in detail, any part or portions of the methods relating to topographical or geographical mapping, which, when necessary to do so, is stated in the "information note" on the printed map.

THE COPPER DEPOSITS OF EASTERN QUEBEC

By John E. Hardman, S.B., M.A.C.

Half a century ago, or to speak precisely, between the years 1859 and 1865, there existed in that portion of Quebec Province which is known as the Eastern Townships, a very respectable and profitable copper mining industry. The capital invested was almost entirely American and came chiefly from the New England States. To-day there are but two properties working in this section which are mining copper, and both of these are owned and controlled by United States capital. The balance of the district is non-productive and idle. It is hoped that the present article may make known a number of facts which will show some reasons for this decline of an industry once so promising, and may indicate that, with modern methods and appliances, a profitable industry can now be inaugurated and maintained successfully.

At the time when copper ore began to be worked and marketed commercially in 1858 the entire production of metallic copper in the United States was about 4,000 tons, and the very high prices which obtained for metallic copper during the American Civil War continued until the highest figure (59¾c) was reached in July, 1864. During the next twelve months, or in June, 1865, this price fell to 29½c, a drop of 30c in twelve months. It must also be remembered that during the decade from 1858 to 1868 the Lake Superior mines first began their commercial production, the Franklin and Pewabic each reaching an output of a million and a half pounds of metallic copper between 1863 and 1865. In consequence of the discovery of the Lake Superior mines, and also by reason of the extreme drop in prices, the American capital interested in the Eastern Townships found a more profitable field in the newly discovered deposits of the Keweenaw Peninsula in Michigan and capital was withdrawn from the Quebec field.

The occurrence of copper in this portion of Quebec, at Brompton Lake, was noted as early as 1841 by Sir William Logan, but before any authoritative printed account was available active mining had begun, and the year 1858 saw the first shipments of sorted ore sent to Swansea. During this year (1858) and those immediately following several Cornish mine captains came out to Canada for the purpose of exploiting these deposits and the names of Captain William Bennett and Captain John Wearne are still remembered in many of the localities where copper ore was formerly mined.

The geology of this section of Quebec has been particularly described in papers by Mr. John A. Dresser, originally communicated to the "Journal of the Canadian Mining Institute" and also published in Volume I of "Economic Geology," 1906. Briefly described the rocks of this eastern portion of Quebec are pre-Cambrian in age and are composed of altered sediments, tuffs and true igneous rocks, the latter being porphyries, andesites and diabases. These rocks have been folded, squeezed, and contorted, forming ridges or anticlines whose general direction is north-east and south-west. In consequence of this folding "lines of least resistance" occur which have afforded passage ways, or channels, for mineral bearing solutions which, by deposition or through replacements, have impregnated the rocks with metallic sulphides of copper and iron, thus forming deposits which vary in thickness from the fraction of an inch to masses occasionally reaching 60 ft. in width. This mineralization of the crystalline rocks appears to have been confined to three ridges or belts running in a north-easterly direction. The first and most westerly of these begins near the south-western corner of Brome County and runs north-easterly through Arthabaska County; the second ridge commences at Lake Memphramagog and runs north-easterly through the City of Sherbrooke up to and beyond Lake St. Francis, this is the most important of the ridges; the third ridge extends along the international boundary between Maine and Quebec, but has only been prospected in a small section near the southern end of Lake Megantic.

These depositions or segregations of metallic mineral usually take the form of elongated ellipses or lenses which sometimes are connected together by a thin stringer of ore, but oftener are entirely disconnected. These lenses are arranged en echelon, and in one of the deepest shafts in the Province, that of the Eustis mine, these lenses have followed one another, and are still existing, to a total depth on the incline of the shaft of 3,300 ft.; in the Albert mine of the Nichols Chemical Company the total depth reached by the incline shaft is between 3,600 and 3,700 ft.

The ores found are divided by their metallurgical characteristics into three distinct groups:

(1) Acid, or siliceous, ores occurring in acid rocks, sometimes with a quartzose gangue.

(2) Basic ores of which the base is chiefly iron, occurring usually in contact deposits having diabase for one wall, and typified best by the Memphramagog mine near Knowlton's Landing.

(3) Basic ores of which the base is chiefly lime, and typified by the Acton, Upton, and Ascot mines.

The principal ore bodies hitherto worked have been those belonging to the first-class and found in the Porphyry-Andesite Schists, the oldest rocks of the region. Ores of the second class are not so common, but usually occur in large bodies; the basic ores of the third class are quite infrequent. Secondary copper minerals such as bornite and chalcocite occur sparingly and the evidence of secondary action is fragmentary and quite insufficient to permit of generalization. The evidence afforded by the older mines which have been worked continuously is to the effect that the ores continue to considerable depth with undiminished values in copper, silver, and gold.

The townships adjacent to and surrounding the city of Sherbrooke contain 50 or more properties which either have produced a respectable tonnage, or have shown bodies of ore which have been prospected in part, but have not yet been developed. The best known of the mines in this class are the Capelton, Eustis, King, Howard, Suffield, Huntingdon, Clarke, etc. Farthest to the north-east is the old Harvey Hill mine, and in the south-west is the once famous Huntingdon mine which has been worked to a depth of about 700 ft.

The values contained in these three different classes of ore do not vary greatly, probably the highest copper values are in the lime-basis ores and the higher silver values with the acid ores. The general average composition obtained from a very large number of samplings gives, for the acid ore, about 60% uncombined silica with from 20 to 25% alumina and iron, and 10% sulphur; the copper averaging 3%. The iron basic ores carry from 45 to 48% metallic iron and from 2½ to 7% of copper. In Mr. Presser's article on this subject (previously referred to in this article) he gives the average of the Capelton Hill as from 4 to 5% in copper, 38 to 40% in sulphur, for the properties on the southern slope of the hill; for the properties on the northern side of the hill he gives a smaller average in sulphur and about the same percentage in copper.

Taking into review the general average of all the copper deposits in the townships, and averaging all classes of ore, the percentage of copper may be taken at not less than 3% and the precious metal (silver and gold) contents at from two to three dollars; the average percentage of sulphur lies between 25 and 30%, of silica between 40 and 45%, and of iron from 15 to 20%. To the metallurgist this average analysis indicate a composition that is readily fusible in the furnace.

During the period of activity in the early '60's several small furnaces and smelting works were built of which only fragments and ruins now exist. All values in these ores, other than sulphur, have been religiously concealed by the companies which have been in existence for over 30 years, and the general public knows of these mines only as containing ores of sulphur and having value only for sulphuric acid making. Undoubtedly this view has been helped largely by the fact that the cinder, after the sulphur has been burned off, has been shipped out of the country to the United States and there smelted, the copper and silver contents being credited to the production of the United Sates and not to the Province of Quebec.

It must also be noted that during the 40 years which have elapsed since the cessation of active work in the townships much railroad building has been done there, and the facilities for shipping ore have been very much increased. Sherbrooke is an important railroad centre having four different lines of railways entering the town, yet renewed interest in the copper resources of the district is still lacking. Investigation has shown that, with the exception of one or two particularly rich deposits, such as the recent discovery at Weedon, the mining of ore to ship and sell abroad is not profitable, and that the hope of a new industry in these ores is dependent upon the advent of smelting facilities which shall be able to treat the ore within a reasonable distance of the mine. The ores offer, if carefully selected an almost ideal assortment for smelting without the use of barren fluxes. In addition to transportation facilities labour in the townships is cheaper than almost anywhere else in Canada and a large supply of electric power is available for all requirements of mining and smelting.

If the reader will take into consideration a few facts it should seem evident that there is the basis here for a permanent industry; the annual importations of copper into the Dominion are about 28,000,000 lbs, all the crude copper shipped from the large mines in British Columbia and those near Sudbury, Ontario, is sent to the United States to be refined, no refined copper is made in Canada. As to the importations, whether in bars, billets, rods, tubes, sheets, or any other form, 90% comes from the United States and 10% from Great Britain. These facts point to the desirability of the Dominion refining its own production of copper, which in crude form totals nearly 100,000,000 lbs. a year.

The small venturer in copper mining will not be successful, and it is admitted at once that a large capital is required to make the deposits of Eastern Quebec profitable. The deposits are large enough and extensive enough to justify the investment of large capital and such investment would have a long period of life and a satisfactory profit. Probably the reason why these fields have so long lain dormant is that they are practically at the doorstep of Montreal and too near to enjoy the benefit of that old Cornish saying which declares that "Far away fields look green."

THE EUSTIS MINE, EUSTIS, QUE.

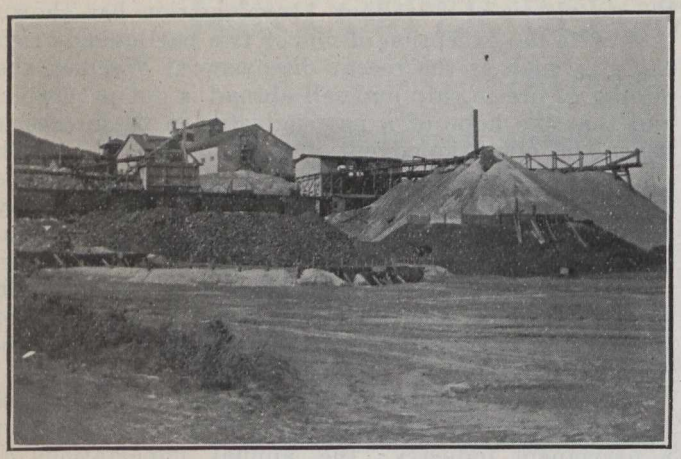
By J. M. Passow, A.R.S.M.*.

The ore bodies of the Eustis Mining Company's mine consist of four well defined lenses. They dip in a southeasterly directions, are parallel to each other, and slightly overlap. The sectional dimensions are approximately as follows: Footwall vein, 50,100 feet long by 4-20 feet thick; main vein, 100-120 feet long by 20-60 feet thick; shaft vein, 50-100 feet long by 3-15 feet thick; No. 1 vein 20-120 feet long by 2-25 feet thick. The footwall vein and shaft vein are richest in copper, averaging from 4 to 8%, while the main and No. 1 vein are richest in sulphur running 42 to 48% S., and 2½% to 4% Cu.

The country rock is a talcy schist, and in places the veins are crossed by diorite dykes which, however, have no effect on the vein; that is the vein remains the same on each side of the dyke. Development working consists chiefly of sinking the shaft in ore and drifting each way along the strike to the end of the ore body, and also cross-cutting the foot and hanging directly under and over these known lenses and about 200,000 tons of good ore is proved up. The shaft is sunk in the smallest vein, and levels are carried off from the shaft to the main vein, and from this crosscuts are driven to the footwall and then a drift is run along the footwall and from this an over stope is started. Often a raise has been made to the next level for air and the miners work upwards standing on the ore they break. The shaft is kept clean by means of a

*Assistant Supt. the Eustis Mining Co.

separate hoist handling a one-ton self-dumping skip, operated by a 20 h.p. motor, and discharging into a bin which loads directly into one of the main hoisting skips by means of a gate worked by a handwheel, rack and pinion. Canadian Rand 3⅛″ piston drills, Holman 3″ piston, Canadian Rand "Butterfly valve" hammer drills, Sullivan hammer drills and Little Hardy self-rotating hammer drills are employed. Air is supplied



Nichols Chemical Co.'s Plant

by a ten-drill electrically driven compressor, a steam driven compressor is held in reserve.

The main shaft is about 3450 feet deep. The ore is taken from an adit level 1,000 feet long which connects with the shaft at 550 feet below the summit of the hill. The double drum hoist operated by 150 h.p. motor, (another 150 h.p. being held in reserve) hoists three-ton self-dumping skips at a speed of about 500 feet per minute up the shaft, which has an average inclination of about 38 degrees; from the skips the ore goes into a loading bin, and thence is loaded into the three 1-ton side discharge cars, constituting the train which is drawn by a 30 h.p. electric locomotive. At some distance after leaving the tunnel the train is dropped down a steep incline by means of a balance weight, rope and drum with a suitable brake. The balance weight, consisting of cars loaded with ore and scrap iron, weighs rather more than the locomotive and empty train, but not as much as the locomotive and loaded train, thus the loaded train draws the counter weight up the incline, while in turn the balance weight performs the same service for the empty train. The maximum capacity of the mine equipment is equal to about 150 tons per shift.

After reaching the mill the ore is dumped from the cars into a grizzly with bars set 2¾″ apart. The oversize goes to the dressing floor where the first class is passed though a 20 by 6 inch and 16 by 10 inch Farrel-Bacon crushers, is then elevated and discharged on to a grizzly with bars set one inch apart and having a ⅜-inch screen beneath, and thence to a trommel having 2⅜-inch holes and an outside fine screen, over half of its length being ⅜-inch square holes. It is then conveyed to bins and transferred from these for shipment to lines on the siding of the Boston & Maine Railway.

The second class ore goes into a 24 by 15 inch Farrel-Bacon crusher and thence by means of a bucket elevator to a trommel having 1¼-inch holes. The undersize passes to a large bin from which it is fed automatically to a set of rolls 30 in. by 20 in. This product is conveyed by a bucket elevator to two trommels covered with 5 by 5 mesh wire; the undersize goes to a Richards classifier and thence to eight Wilfly tables. The oversize goes to two sets of 20 x 8 inch rolls and back to the aforesaid elevator; the oversize from this screen goes to an 11 by 15 Dodge crusher and into the same elevator as the discharge from the 24 by 15 inch crusher. The rock is dumped by car outside the mill. The concentrating plant has a capacity of about ten tons of mill feed per hour, and the dump plant about fifteen tons per hour.

The B. & M. side track will hold thirteen railroad cars above the bins. The loading bins will hold about 800 tons of lump and 100 tons of fines. Any excess above weekly shipments is dumped on stock piles below the mill, as are all the wet concentrates in order to dry them. There are four tunnels beneath the stock piles, and in the tunnels under the fines is a belt conveyer which loads directly into the cars in the tunnel. Under the lump pile an electrically operated self-pump skip is loaded through the holes in the roof of the tunnel and dumped into one of the loading bins. A 30-ton car has been loaded in eight minutes with the belt conveyer.

The machinery in general is operated by electricity, generated at the Eustis Mining Company's plant on the Coaticook River about two miles distant. The power house contains one 250 and one 150 k.w. machine. The available head is 32 feet, and the current is 3 phase, 25 cycle, 2200 volt.

THIS SUMMER'S FIELD WORK OF THE GEOLOGICAL SURVEY—GEOLOGICAL DIVISION

Field Parties for 1912.

Cairnes, D.D.—Completion of the geological section along the Alaska-Yukon boundary between the Porcupine and Yukon rivers. Preparation of the guide book of the Yukon excursion (I.G.C.) between Prince Rupert and Dawson.

Malloch, G.—Explorations in the Ground Hog coal basin and elsewhere along the head waters of the Skeena River. Examination of reported coal area on Sustut Creek and two coal basins just north of Hazelton.

McConnell, R. G.—Detailed investigation of the magnetite and gold-copper deposits of Texada Island. Explorations in Rainy Hollow and vicinity. Preparation of guide book of Prince Rupert-Aldermere excursion (I.G.C.) along the Grand Trunk Pacific.

Clapp, C. H.—Completion of the geological mapping of the Sooke and Duncan sheets. Preparation of the guide book of the Vancouver Island excursion on (I.G.C.). Detailed examination of mineralized belt on East Sooke Peninsula.

Bowen, N. L.—Mapping geological section on Canadian Pacific Railway between Lytton and Vancouver.

Bateman, A. M.—Explorations is gold-bearing areas between Bridge River and Chilco Lake.

Drysdale, C. W.—Mapping geological section on Canadian Pacific Railway between Six-Mile Point and Lytton.

Rose, B.—Petrographical and structural investigations of the tertiary rocks exposed between Savonas and Six-Mile Point.

Daly, R. A.—Mapping geological section along Canadian Pacific Railway between Revelstoke and Golden. Supervisions of Allan, Drysdale and Rose.

Allan, J. A.—Mapping geological section along Canadian Pacific Railway between Golden and Banff. Completion of the southwest corner of Ice River sheet.

Walcott, C. D.—Palaeontological investigations in the Yellowhead Pass.

Camsell, C.—Examination of mineralized areas on Kruger, Copper and Apex Mountains and at White Lake, Similkameen Mining Division. Preparation of guide book for excursion (I.G.C.) between Midway and Spence's Bridge. Supervision of Bateman and Bowen.

LeRoy, O. E.—General supervision in connection with excursions of the International Geological Congress. Preparation of guide books for West Kootenay, Boundary and Vancouver excursions (I.G.C.).

Schofield, S. J.—Geological mapping of the south portion of East Kootenay between Canadian Pacific Railway and International Boundary. Preparation of guide book for excursion (I.G.C.) between Elko and Kootenay Landing.

Leach, W.—Geological mapping of the Blairmore area. Preparation of the guide book for excursion (I.G.C.) between Burmis and Elko.

MacKenzie, J. D.—Explorations in the coal fields of Southwestern Alberta between the Blairmore-Frank area and the International Boundary.

Dowling, D. B.—Preparation of guide books for excursions (I.G.C.) on the plains and in portions of the Rocky Mountains between the Grand Trunk Pacific and the Crow's Nest Branch of the C.P.R. Examination of the Flathead coal area. Supervision of Malloch and Mackenzie.

Moore, E. S. (assisted by R. A. Wallace).—Explorations east of Lake Winnipeg in the Hole River District and adjoining areas.

McLean, A.—Preparation of the guide book for excursion (I.G.C.) between Winnipeg and Rosebud via Saskatoon.

Trueman, J. D.—Revision of the geology of the Seine River sheet. Preparation of the guide book for excursion (I.G.C.) between Port Arthur and Winnipeg along the Canadian Northern Railway.

Collins, W. H. (assisted by J. J. O'Neill).—Completion of geological mapping of sheet No. 139 north of Sudbury. Preparation of guide book for excursion (I.G.C.) between Nipigon and Winnipeg along the National Transatlantic Railway.

Johnston, W. A.—Completion of geological mapping of the Beaverton, Sutton and Barrie sheets, Simcoe district. Preparation of guide book for Orillia excursion (I.G.C.).

Williams, M. Y.—Geological mapping of east portion of Manitoulin Island, including the Townships Tehkumah, Assignack and Sheginandah and the unsurveyed territory to the east.

Foerste, Aug.—Continuation of investigations in Ordovician of Manitoulin Island.

Taylor, F. B.—Continuation of investigations on the Pleistocene in Western Ontario.

Stauffer, C. R.—Examination of Upper Monroe formation to complete studies on the Devonian in Southwestern Ontario. Preparation of guide maps for the Geological Congress in vicinity of Waterford and Port Colborne.

Wilson, M. E.—Exploration of area between Lake Kipawa and the junction of the Bell River and Nat. Trans. Railway, via Grand Lake Victoria.

Cooke, H. C.—Exploration of area between Middle Gull and Evans Lake and eastwards along Mill, Victoria and Nipukatasi rivers. Examination of reported occurrences of gold on Kiemawisk Lake.

Keele, J.—Investigation of the clay deposits of the Province of Quebec.

Harvie, R.—Completion of the geological mapping of the Orford sheet. Mapping geological section between Knowlton Landing and Cowansville. Preparation of guide book for the Asbestos excursion (I.G.C.).

Stansfield, J.—Preparation of guide maps for the Geological Congress in the vicinity of Guelph, Hamilton, Streetsville and Forks of Credit, Province of Ontario. Geological mapping of Mount Royal and vicinity. Preparation of guide book for A-8 excursion (I.G.C.). "The Mineral Deposits of the Ottawa District."

Goldthwait, J. W.—Continuation of work on marine shore lines in the Province of Quebec. Re-examination of beaches between Quebec and the Adirondacks.

Young, G. A.—Preparation of the guide book for the Quebec-Maritime Province excursion (I.G.C.). Supervision of Bell, Wright and Harvie.

Bell, W. A.—Continuation of work on the carboniferous section at Joggings. Palaeontological investigation in the vicinity of Windsor.

Wright, W. J.—Continuation of the investigation of the granites of Nova Scotia, with special reference to their economic importance.

Faribault, E. R.—Continuation of the geological mapping of the gold area of Nova Scotia. Completion of sheets 93, 94, 95 and 98. Examination of scheelite deposit at Scheelite and the prospects in the vicinity of New Ross. Supervision of Wright.

Raymond, P. E.—Palaeontological investigations at Quebec, in the Maritime Provinces and between Collingwood and Kingston in Ontario. Preparation of the guide book for A-11 excursion (I.G.C.). "The Ordovician at Montreal and Ottawa."

Hyde, J. E.—Palaeontological investigations in New Brunswick and Nova Scotia.

THE QUEBEC IRON INDUSTRY.

The immediate prospects of the iron industry in Quebec are not especially bright. The bog ore deposits of St. Maurice and of Drummond County appear to be approaching exhaustion, and while other iron ore occurrences, including the magnetic sands on the north shore of the St. Lawrence are known, their utilization for some time to come is not probable. Prof. Dulieux's final report on the titaniferous ores and the magnetic sands in the localities he is investigating is meanwhile looked for with interest, as heretofore, no comprehensive official pronouncement concerning the economic value of these occurrences has been made, and current reports are decidedly conflicting. It may be mentioned as a fact not generally known that Prof. Lewes, of Newcastle,

England, was retained some few years ago to examine and report on the St. Lawrence sands for an English syndicate. It was commonly supposed that while the deposit was extensive, the question of its utilization was dependent on the devision of a cheap and adequate method of concentrating and vriquetting the sands. Prof. Lewes, however, informed the writer that the matter of treatment presented no obstacle, but that the deposit itself was too shallow for profitable working.

In 1911, the only furnace in blast was that of the Canada Iron Furnace Co. at Drummondville. The production of pig-iron was 655 tons, valued at $17,280, while only 931 tons of local iron ore was produced during the year.

A minor but profitable industry is the manufacture of ferro-phosphorus, conducted by the Electric Reduction Company, at Buckingham. The output last year was 25 tons. For some years other ferro compounds, such as ferro-silicon and ferro-chromium were also manufactured; but at present the effort of the company is directed almost exclusively to the manufacture of phosphorous.

THE SUFFIELD COPPER MINE, ASCOT TOWNSHIP, QUE.

The Suffield mine is situated about seven miles southwest of the City of Sherbrooke, in the Township of Ascot. The property, comprising 600 acres, is owned and the mine operated by Mr. A. L. Norton. Copper was first discovered on this property about 60 years ago, much prospecting was done without, however, disclosing any valuable body of ore, and the work was discontinued. Some 30 years later a new discovery was made and for a number of years active mining development was in progress, but after a quantity of low-grade ore had been mined, work was again discontinued until 1906, when the property was acquired by Mr. Norton. Under his direction development operations were resumed and necessary machinery provided, including a 100 h.p. boiler, a 50 h.p. hoisting engine and a 5-drill Ingersoll-Sergent compressor. A shaft was sunk to a depth of 320 feet on an incline of 35 degrees, following the foot-wall of the ore body; drifts of 200 feet, 300 feet and 250 feet were driven on the first, second and third levels, respectively, and upraises were made at intervals of 100 feet, connecting the different levels. Development is still proceeding on the third level. All the mining has been in ore, and, to indicate the size of the ore-body, it may be stated that a crosscut passing through 40 feet of ore failed to reach the hanging wall. About 5,000 tons of ore have been hoisted, but up to date no ore has been shipped.

The ore occurs as desiminated pyrite and chalcopyrite in a highly silicious, serpentinized schist. The copper content varies from 2¼ to 5%, and occasionally as high as 9%. The sulphur averages about 30% per cent. The ore also carries small quantities of gold and silver. Concentration would evidently be necessary before the ore could be marketed to advantage.

The tracks of both the Boston and Maine and the Canadian Pacific Railways pass within two miles of the mine.

THE NATURAL RESOURCES DEPARTMENT OF THE C.P.R.

By L. O. Armstrong.

The Canadian Pacific has recently organized a very important department, namely, that of Natural Resources, under the direction of Mr. J. S. Dennis. For eastern lines the writer is Industrial and Colonization Agent, and has charge of the development of the mineral and other natural resources. When new discoveries and prospects are brought to his notice he makes a personal investigation, and, if favourably impressed, engages the services of a competent engineer to report.

At present the possible utilization of deposits of silica sand for glass-making and for the higher class cement products is attracting attention. No window glass is made in Canada and there is a very large importation of bottles, notwithstanding the fact that Canada has very large deposits of glass sand suitable for the manufacture of glass of the best quality. The development of copper areas in the eastern division is also being considered.

According to the department's records, the natural resources in Quebec now include alluvial gold deposits with accasional gold veins now being worked in the County of Megantic, on the Chaudiere River, which has a 500 h.p. watefall available. Springhill, Quebec, reports gold; Scotstown, copper and gold, with a good opening for an economic plant. At Eastman, asbestos is found, also copper and iron.

The Quebec Central Railroad runs through one of the best mineralized portions of the Province of Quebec. Copper, asbestos, chrome ore, iron ore, limestones and other economic minerals found here, make it a very attractive field. The rail and water connections are good, either from Quebec, Montreal, Portland, Boston, or New York. On the north shore of the St. Lawrence, east and west of Quebec, and in Eastern Ontario, are some of the largest titaniferous iron ore deposits in the world. The Province of Quebec has large and rich deposits of ore to supply the world for many centuries at the present rate of consumption. There are rich clays and limestones along the north shore of the St. Lawrence, between Quebec and Montreal. The oldest iron furnaces in Canada are at Radnor Forges, near Three Rivers.

The water power development is already very large, and there is more power to develop on the St. Maurice River. The development of the iron industry has barely begun.

There is natural gas on the north shore of the valley of the St. Lawrence. In the Laurentian Mountains between Quebec and Ottawa, is a vast, almost untouched territory. The few prospectors that have worked there have found magnesite, gaphite and rich titaniferous iron ore ilmanite. Large bodies of these minerals are well situated as to railway facilities, and there is water power to be had almost everywhere.

Graphite, magnesite, and mica are found between Labelle, north of Montreal, Grenville, and Ottawa. There are extensive and rich bodies of natural phosphate (apatite) in this section of the country. The phosphate and graphite are now being worked profit-

ably. Half a million horse power could be developed if necessary at several points in this district by concentration.

At East Templeton there is a body of feldspar of good quality. On the Gatineau River, north of Ottawa, are mica, phosphate, gold, marble, graphite and dolomite. There are splendid water powers in the Ottawa Valley from Ottawa to Waltham, and along the Canadian Pacific Railway from Ottawa to Port Arthur and Fort William, Ontario.

STRUCTURAL AND NON-METALLIC PRODUCTS IN QUEBEC.

Marble.—Reference has been made elsewhere in this issue to the development of the marble resources of the Province. It may be added, however, that in addition to the two important enterprises particularized, a new undertaking has recently been inaugurated at Portage du Fort, under the name of the Pontiac Marble Stone Co. Here a quarry is being opened and sawing and dressing machinery provided with a view to the early marketing of the product.

Koalin.—Another new undertaking is that of the St. James Construction Company under whose auspices the Kaolin deposits of Amherst Township are now being worked. There is an excellent market for Kaolin, which is used in the manufacture of both pottery and paper.

Cement.—The manufacture of cement in the province is an important and growing industry, the production in 1911 being 1,588,283 barrels (350 lbs. capacity) valued at $1,931,783. Production is controlled by the Canada Cement Company, whose Quebec works are at Hull, Longue Pointe and Pointe-aux-Trembles.

Glass Sand.—A small quantity of glass sand from West Shefford was tested last year by glass manufacturers in Montreal. The results, however, are stated to have been unsatisfactory.

Sandstone.—The only sandstone quarried last year was in a locality of Gingues Township, on the shore of Lake Temiskaming. The stone, which dresses easily and has a pleasing buff colour, is quarried from a vein of the Niagara formation, resting directly on the pre-Cambrian and outcropping from Piché Point on Lake Temiskaming, for a distance of about three miles northward.

Feldspar.—Production in 1911 was limited to a few tons mined from a deposit on Manicouagan Bay, near Washeesho River, opposite the Island of Anticosti, and consigned for trial purposes to potteries at Trenton, New Jersey, and in England.

CHROMITE IN QUEBEC.

It is regrettable that past attempts to utilize the chrome iron deposits of the Eastern Townships have not been successful. Chromite occurs in large quantities in the Serpentine belt between Disraeli and Broughton, but mining has been confined to the Coleraine-Black Lake district. The ore here is of excellent quality, much of it being readily marketable without concentration, that is to say, containing over 40 per cent. chromium sesquioxide. There can be no doubt that the deposits could be profitably mined under skilled direction and some of the mines are, it is understood, to be re-opened this year.

In 1911 small shipments were made from stock-piles to local consumers requiring refractory material for furnace lining, while a sample lot was consigned to a manufacturer of ferro-chrome at Niagara Falls.

THE WEEDON (McDONALD) MINE, WEEDON, QUEBEC

East Canada Smelting Co.

The following information concerning the McDonald mine was obtained by a representative of the "Canadian Mining Journal" from Mr. Leland D. Adams, manager of the mine for the East Canada Smelting Company. The operating company, by the way, is an American corporation with headquarters at 17 Battery Place, New York City. For many years the district, of which Weedon has become the centre, was known to contain copper-bearing measures. It remained, however, for the United States investor to take the initiative in developing this promising region.

Property.

The property owned by the East Canada Smelting Company is now known as the Weedon mine. Formerly it went under the name of the McDonald mine. The company's holding comprise lots 22 A, B, C, and D, range 2; and lots 22 A, and B, range 3, in Weedon Township, Wolfe County, Province of Quebec. The total area is 375 acres of which 150 acres have been cleared for farming purposes. The remainder is thinly wooded, but it will yield enough timber for mining purposes for a number of years to come. The mine is about 200 feet above the town of Weedon, a station on the Quebec Central Railway, and about four miles distant.

History.

The property is mentioned casually in the early geological reports of the Quebec Government. The large area of gossan at one time attracted much attention, and resulted in the sinking of many shallow pits, none of which was on the ore body. In 1909 a shaft was sunk to a depth of 20 feet. The bottom of this shaft showed a solid body of pyrite and chalcopyrite. It was on this showing that the East Canada Smelting Company purchased the property. After assuming ownership, a year was spent in developing and diamond drilling. In August, 1910, the first shipments of ore were made. These were sent to the chemical plant at Capelton, P. Q., where the Nichols Chemical Co. operates a sulphuric acid plant. All shipments in 1910 and 1911 averaged 5% copper and 42% sulphur. In January, 1912, the tonnage was brought up to 150 tons per day, and the development ratio set at one ton extracted to three developed.

Geology.

On a low ridge forming the eastern limits of the St. Francis valley is the site of the property. The apex of the ridge is an acid granite, and the flank is a schist of pre-Cambrian age. This schist lies on a rock having much the appearance of a fine grained diabase, which is locally designated "trap." The ore is found with the

contact of schist and diabase, and the mineralization decreases as distance is gained from the diabase. Disseminated pyrite and chalcopyrite are found three and four hundred feet from the contact. The contact between the granite and schist and between the schist and trap roughly parallel each other at a distance of about 700 feet apart. Secondary enrichment has not played an important part. The only secondary minerals found, chalcocite and bornite, occur in small quantities.

The principal minerals are pyrite and chalcopyrite, with occasional stringers of galena and sphalerite. The non-metallic minerals are quartz, chlorite, and sericite. These are unimportant, however, as the percentage of

Mine Workings.

The main shaft No. 2 is down 300 feet, measured along the dip of the vein. At a point 165 feet south of the main shaft is the No. 1 shaft. This shaft is also an incline, sunk in ore with the exception of the first 19 feet, which is vertical. There are three levels open, th No. 1, 530 feet long, No. 2, 400 feet, and No. 3, 250 feet. The limits of commercial ore have not yet been reached on any of the levels. With the exception of No. 1 level all are being extended in ore. A winze has been sunk 60 feet below the third level. Each level is being thoroughly crosscut in laying out the mining system. Only 30 feet of work has been done in waste in the entire mine.

Mining.

In opening a new level a winze is sunk to the required distance, a drift is then run under the shaft and the raise driven to connect with the shaft at the level above. In this way hoisting in the main shaft is not interrupted by sinking operations, and much less water is encountered.

The cost of the shaft has been reduced from $30 to $12 per. foot, as well be seen, it is possible to use small hammer drills in the raise, and, since little water is encountered and there is no stoppage of hoisting in the main shaft, the work is carried on without interruption.

In drifting on a new level the foot-wall is followed as closely as possible. A second machine follows the first, making the drift wide enough for a double etrack.

The stoping method employed depends upon the width of ore to be stoped. For all widths less than 10 feet, stulls and lagging are used to support the broken ore in the stope, the chutes being placed at intervals of 15 feet. For widths over 10 feet and under 20 feet, a pillar is left over the level with chutes at every 20 feet in raises that have been run through the pillar. This pillar is from 20 to 15 feet thick measured along the foot-wall.

In preparing a stope of this kind, a sub-level is run 20 feet above the haulage level. These two levels are then connected with the raises at every 20 feet. At intervals of 100 feet raises are made to the level above to the used as manways, and to bring in the air pipes. For widths greater than 20 feet, cross-cuts are run for thirty feet to the limits of commercial ore. These cross-cuts are then carried up as shrinkage stopes. All stoping is done by the shrinkage system and all hoisting from one level in one to skips. A raise from the hoisting level to the level above is used as an ore pocket, and it is stored with several days' supply of ore.

Costs.

The following costs are computed from the first four months' operations in 1912:

Direct mining	$ .70
Development	.28
Surface handling	.21
General expense	.16
Property	.17
Total cost per ton	1.52

Supply costs per ton are as follows:

Candles	.01
Powder	.08
Oils	.02
Fuel	.10
Repairs and renewals	.08
Labor costs exclusive of drilling are	.44

Development costs (the work being done by contract)

Drifting single track drift	10.00
Raising	8.00
Sinking winze, 10 by 6	14.00

Tramway.

A Bleichert tramway is being constructed from the mine to Copper Siding, a point on the Quebec Central Railway. The tram line will be 19,500 feet long and will cost at the rate of $1.75 per foot. Three hundred thousand feet of lumber, (board measure) was used in construction. The average height of tower was thirty feet. Construction was greatly handicapped by continual rain. Floods necessitated the placing of 14 towers and one tension station on pile foundations. The ore bins at the siding will hold two thousand tons, and the siding is arranged to handle the empty cars by gravity. The siding will accommodate twenty cars.

The line will handle 400 tons per day and is operated by a twenty h.p. engine. Coal and supplies will be brought back by the returning carriers.

QUEBEC COPPER INDUSTRY IN 1911.

In 1911 the production of pyritous copper ores substantially increased the shipments, namely 38,554 tons exceeding the record since 1899. Apart from a small trial shipment made from the Eastman, the whole of this production was derived from, respectively, the Eustis mine, at Eustis, and the McDonald mine, at Weedon. More extended notice is made to these mines elsewhere in this issue; but it may be added that recent development work at the Eustis has resulted in the blocking out of two years' ore supply; while it is also of interest to learn that the treatment of the ore by the Elmore process is being considered. Under the present management costs at the McDonald mine have been very materially reduced, and production at the rate of 2,000 tons monthly is being steadily maintained. The deposit is lenticular in form and of very considerable dimensions as indicated by the development work so far performed. The mineral content of the ore shipped last year averaged over 42% sulphur and nearly 5% copper.

Other copper mining operations in the Province included work at the old St Ives mine, near Eastman, where a promising body of chalcopyrite was uncovered: continued development of the Suffield mine; the unwatering of the Harrington; and the development of a number of claims in localities to the north-east of the McDonald mine, as well as in Lake Megantic region.

SPECIAL CORRESPONDENCE

NOVA SCOTIA

Dominion Coal Outputs.

The Coal Company's outputs in the first half of June established a new series of production records. The out put for the thirteen days of the first fortnight was over 200,000 tons. In the week ending the 15th, the daily outputs were as follows:

Monday, 10th	15,144
Tuesday, 11th	17,007
Wednesday, 12th	17,648
Thursday, 13th	17,151
Friday, 14th	18,029
Saturday, 15th	14,286
	99,265 tons

The best previous day's output was 17,063 tons, obtained at the end of April this year.

The outputs of the individual mines on the 14th June were as under:

No. 1	2,163
2	3,376
3	435
4	1,667
5	1,073
6	1,130
7	775
8	693
9	1,990
10	863
12	1,232
14	1,211
15	624
16	585
21	143
22	69
	18,029 tons

It will be noticed that the new mines at Lingan are responsible for 3,600 tons of this output, and in August it is expected that these four collieries will be producing 4,000 tons daily. No. 21 Colliery will obtain a much increased output very shortly, and will probably be producing 500 tons daily in two months' time. Barring the possibility of accidents, never absent in mining operations, it will not be surprising to see occasional daily outputs this summer of from 19,000 to 19,500 tons. The 20,000-ton mark will hardly be reached in the present season, but it should be a possibility in 1913.

In a previous communication your correspondent referred to the great drop in outputs which followed the fortnightly pay-days. This is well exemplified by the output of 14,286 tons obtained on the 15th, which was the pay-day, compared with 18,029 on the day before. In the fortnight under review the output for the six days, including and following the pay-day, was 86,000 tons, against 100,000 tons for the six days preceding the pay-day, or a shrinkage of 14,000 tons directly due to time lost by men after pay-day. It is a statement well within the mark to say that if this pay-day loss could be eliminated the Dominion Coal Company's outputs could be increased by at least 20,000 tons a month, and that the miners' pockets would be correspondingly richer. As your correspondent has previously pointed out, the sale of liquor being illegal in Cape Breton and the purveyor of liquor an outlaw, the purveyance of liquor is carried on without the possibility of regulation as to quality, quantity or location. The logical result is that bad liquor is sold, in unlimited quantity, in secret and shameless dives. The revenue which should be derived from a licensed traffic, a revenue that would be a most substantial assistance to education and roads, is lost altogether. Large sums of money are paid to inspectors under the Nova Scotia Temperance Act, as salaries, their duties being supposed to be the suppression of an illegal traffic. The fines imposed are frittered away on fighting writs of replevin, writs of habeas corpus, and all the puzzling and anomalous legal technicalities which are raised in never-ending succession by the resourceful lawyers of the liquor dealers, and which naturally arise out of the extraordinary state of affairs which tacitly permits an illegal traffic, much as one might say: "Your traffic is illegal, but we recognize that the law is impossible." A little impartial investigation of the actual conditions would convince all but the most prejudiced and intemperate prohibitionist that it would be far better to regulate this traffic legally than to perpetuate any longer a state of affairs which, while it recalls a comic opera in its topsy-turveydom, is actually pregnant with dreadful tragedy.

ONTARIO

Cobalt, Gowganda, and Elk Lake.

From Northern Ontario last month silver, gold, and nickel ore was exported, silver of course from the Cobalt camp, gold from the McEaneny, and nickel from the Alexo mine near the Frederickhouse. This is, of course, in addition to the silver bullion from Cobalt and the gold bullion from the McIntyre and Dome mills at Porcupine. The official shipments as compiled by Mr. A. A. Cole for the T. & N. O. commission reads:

Cobalt.

Mine	Tons.
Buffalo	92.24
Beaver	55.55
Chambers-Ferland	64.00
Cobalt Townsite	157.62
Colonial	21.60
Cobalt Lake	31.15
Coniagas	172.35
Crown Reserve	38.95
Drummond	18.56
Hudson Bay	62.75
Kerr Lake	50.77
La Rose	424.03
McKinley-Darragh	220.38
Nipissing	196.80
O'Brien	63.96
Temiskaming	197.64
Trethewey	60.37
	1,928.72

Porcupine.

McEaneny (gold)	30.99
Alexo Mines (nickel)	65.00

This ore was shipped as follows:

	Per Cent.
Canada	46.97
United States	53.03

The lowest price of silver during the month was 60.125 cents, highest 61.375.

The Nipissing shipped ore of an estimated net value of $213,214 and mined ore of an estimated net value of $226,140.

At the Meyer vein on the 245-foot level two small but rich veins have been located.

At shaft 64 exploration work is in progress at 368 feet, but with no definite results so far.

An intermediate drift on a branch of vein 100 is now in 49 feet, and for most of this distance the vein shows good width and values. At the end of the month the face shows two inches of ore assaying three thousand ounces.

The new ore shoot found in April at vein 22 proved to have a length of 40 feet. The ore was very high grade and during the month stoping on the shoot produced $57,000.

The new shaft near the Savage line is down 178 feet, and is still in good coarse conglomerate.

The high grade mill treated 175 tons of ore during the month and shipped 298,973 ounces of fine silver.

Construction is proceeding rapidly at the new low grade mill, the frame work of all the main buildings being completed and a large part of the interior concrete work has been finished. Considerable supplies are already on the ground.

It is very probable that before this is published the Ontario Government will have announced a general reduction of the royalties to be paid by certain Cobalt mines. The mines likely to be affected and the present royalties rates they are paying are: Cobalt Townsite, 25 per cent. net; City of Cobalt, 25 per cent. net; Hargrave, 25 per cent. net; O'Brien, 25 per cent. gross; Crown Reserve, 10 per cent. gross; Chambers-Ferland, 25 per cent. net; T. & H. B., 15 per cent. gross, and various others that are not on the shipping list. The reduction will undoubtedly lead to increased activity among the companies affected as many of them have felt for some time that all the profit they were making or were likely to make would be skimmed off by the Government, and this had no tendency to accelerate shipments or encourage exploration. All mines, of course, have to pay the 3 per cent. royalty charge to the Government.

A report for five months issued by the Crown Reserve Mining Company shows that gross production was 1,143,142 ounces or $699,847 less all expense and depreciation $140,407, leaving a profit on mining operations of $559,438. The royalty for five months amounted to $64,346, and dividends paid monthly for five months to $442,203. The net surplus for the first five months of the year showed $52,889, and the total surplus now amounts to $817,741.

Work has been resumed on the John Black claims in South Coleman for the past month. The vein has been cut at the 300-foot level, and while it is from three to six inches wide and shows niccolite and smaltite the silver values are low at present. A development fund has been raised ample to carry on work for some time on the property.

The Wettlaufer has declared its regular 5 per cent. per quarter dividend, payable on July 20. The Wettlaufer has now paid 30 per cent. or $450,000. The Wettlaufer is now the only mine operating in the South Lorrain section, but there are prospects of quite a number of others commencing operations before long.

A good strike is reported from the Donaldson property at Elk Lake. A vein was followed down to the 100-foot level, but the silver in it was not sufficient to make it profitable for shipping nor was it much better in the drift till a point 40 feet from the shaft had been reached. The vein then, it is reported, widened to four to eight inches of two thousand ounce ore.

A two-stamp mill is now in operation on the Ruby Silver property near North Cobalt. The company in control is known as the Lost and Found Mining Co., of Buffalo. The mill is for the purpose of testing the ore.

The Nova Scotia mill, now the property of D. M. Steindler and his associates, has opened up again as a customs mill. Before the Nova Scotia Company went into liquidation it had obtained contracts from the Crown Reserve and the Kerr Lake to mill their low grade ores so many tons per month. The fact that the company went into liquidation rendered the contracts null and void, but they have been renewed with the owners of the present mill.

The annual report of the Buffalo mines shows that the total production during the year amounted to 1,525,262 ounces, while the ore reserves were approximately increased by 41,000 tons of a value of 38 ounces per ton, or 1,500,000 ounces. These reserves are principally on No. 10 vein. The mill treated 46,801 tons averaging 32.36 ounces per ton, a total of 1,490,760 ounces, of which 80.63 per cent. was recovered. The income from mining operations amounted to $853,807, while the net income was $451,154. The dividends paid during the year amounted to $370,000, and $81,154 was added to the surplus, which now amounts to $389,577.

The Casey Cobalt has just shipped a car of ore weighing over 47 tons, which is to date the richest which has ever left the Cobalt camp. It was valued at $132,235, which is about $5,000 more than the previous highest car from the Temiskaming mine.

The Hollinger mill dropped thirty stamps on June 15 and the mill should be running on ore within a few days. It is too much to expect that any tonnage can be attained before the first of July as only thirty of the forty stamps have as yet been installed, and there is a lot of work to be done yet before it can be said that the plant is in good running order.

The Vipond mill has been unduly delayed by the non-arrival of one ten horse power motor. The mill has now been ready to start for two or three weeks if this particular piece of machinery had arrived.

At the Dome mill all difficulties have at length been overcome and the mill should soon be treating full capacity. At present about 300 tons are being treated daily. All the tube mills are at length in commission. The incomplete returns which have from time to time appeared in the press have been so inaccurately used to arrive at the output that the management has taken the greatest pains to see that not even the amount of gold that is being shipped from the mill should get known. It is possible that when the mill is running smoothly the embargo on all information will be lifted. It is understood that the ore in the mill is running about $11.50 to the ton.

The Little Pet mine has closed down so that it is probable that the five-stamp mill in course of construction there will figure as one of the camps bullion producers.

The main vein of the Swastika mine has been opened up at the 400-foot level and shows from four and a half to five feet wide of solid quartz. It was cut but 25 feet from the shaft. This is the best width of quartz that the mine can show except at the 100-foot level, the ore body being badly broken up at the 300 and the 200-foot levels. If the assays hold up in the new ore body this strike will very greatly enhance the value of the property.

Development at the Dome Lake mine continues to be very satisfactory. On the No. 1 vein the shaft is now down 48 feet and at this depth there is quartz all across the working. This does not appear to be of such high average value as in the main vein, but it should be all good pay ore. A complete compressor plant is being installed and a site has been chosen for the erection of the ten stamp mill.

It is understood that the Lucy Cross at Swastika will erect a five stamp mill. It will cost about $7,500 to erect. The vein was lost at the 100-foot level, but has recently been opened up again in a raise where it is rich as it was on the surface.

BRITISH COLUMBIA

A statement published recently in Nelson was that a visitor from Chicago "remarked upon the large sums of United States capital which are being spent upon the development of such mines as the Payne, the Rambler-Cariboo, the Rio, the Standard and numerous other properties in various parts of Kootenay, in addition to the Mother Lode at Sheep Creek, where the big mill is about to produce gold." This is misleading, at any rate so far as the Standard and Mother Lode are concerned, while it is also incorrect to suggest that a a "large sum" has been spent in developing the Rio, which as yet is a comparatively unimportant property and has never had any considerable number of men employed on it. As to the Payne, it is true a long crosscut tunnel is being driven, but it will be some time before it can be correctly stated that a "large sum" of money has been spent on its development by United States capitalists. Now, in calling attention to this instance, which is only one of many, of incorrect "mining news" being published in Nelson, there is no intention to attempt to disparage mining men resident in the United States in relation to their enterprise in developing mining properties in British Columbia. In a general way it may be stated that they are doing, and have done, more to develop the mineral resources of this province than Canadians and Old Country people combined. But inaccuracy is characteristic of other newspapers as well as that published at Nelson, when printing information—or, frequently, mis-information—relative to mining in the province. Take, for instance, the reference in the above quoted newspaper statement to the "big mill" of the Mother Lode at Sheep Creek—how can it be truthfully maintained that a 10-stamp mill is a "big" mill? This is not suggesting that that mill is not a good one, for its equipment is modern and it is quite likely it will be found one of the most effective gold-saving mills in the province. Then as to United States capital taking a prominent part in the development of the Mother Lode mine, Ontario readers of the Canadian Mining Journal will smile at the suggestion that Mr. John McMartin, of Cobalt and Porcupine fame, is one of the United States capitalists the Nelson newspaper includes in its generalities when it publishes statements like that here challenged. Yet Mr. John McMartin is president of (and chief shareholder in) the Mother Lode Sheep Creek Mining Company, Mr. Duncan McMartin is vice-president, and Mr. L. H. Timmins is also a director. Then as to the Standard, for years the development work of this mine has been paid for out of proceeds of ore extracted in the course of that development. During 1911 the Spokane men largely interested in it doubtless found money for an aerial tramway, concentrating mill, compressor plant and water system for power and mill purposes, but notwithstanding that the mill was not completed and ready for operation until November last. In April the Standard Silver-Lead Mining Company paid a dividend totalling $25,000, and in May and June $50,000 each, with the expectation that it will be found practicable to regularly divide $50,000 a month among the shareholders. As regards other properties, it is true that United States men are largely interested in mining in Kootenay and Boundary districts, but only in a comparatively few instances have they supplied "large sums" of money for the development and equipment of mines in those districts, much of the cost of these having been obtained from the proceeds of ore taken out of the mines acquired by those men.

South Belt of Rossland Camp.

The development of several mining properties in the south belt of Rossland Camp, although not yet on a large scale, appears to be giving encouraging results. Those of which the Rossland Miner has published most information during the last few months are the Bluebird, Phoenix and Richmond group. On June 5, some particulars were printed of progress on two of these.

The lessees of the Phoenix were stated to have had —at the beginning of June—some 300 sacks of ore ready to be sent to the smeltery at Trail as a trial shipment. The lode from which the ore was taken was described as being three feet wide, with paystreaks of high-grade ore, about a foot in width, on both hanging and footwalls. The ore is described as being fine-grained pyrrhotite, containing little copper, but averaging about $30 per ton in gold.

A second find of ore on the Hattie claim of the Richmond group was reported, this being about 200 feet from where ore was found three weeks earlier. The lode was stated to be 15 feet in width, and to have been found to run parallel with a dike for several hundred feet.

The Miner urged local residents to show the utmost faith in the mining properties in the south belt by putting money—or its equivalent, labour—into the further development of claims in that part of Rossland Camp. It commended the energy of local miners who have to some extent shown the possibilities of this part of the camp, and expressed the opinion that if this home effort be kept up and several regular shipping mines be established as a result, there will not long be a lack of capital for further development of the resources of the camp, and the maintenance of its prosperity.

Windfall Group, Hedley Camp.

The Windfall group of mineral claims, adjoining the Nickel Plate on the northwest, in Camp Hedley, Similkameen, has been taken under bond and option of purchase by the Hedley Gold Mining Company, owners of the Nickel Plate group.

Mr. Charles Camsell, in his Memoir No. 2, "The Geology and Ore Deposits of Hedley Mining District, B.C.," stated that "the first record of a mineral claim in Camp Hedley was in 1894, when C. Allison and J. Reardon staked three claims for the Hon. E. Dewdney and others, on ground that is now covered by the Climax, Windfall, Winchester, Lookout, and part of the Nickel Plate mineral claims. Mr. Coulthard also had a claim on what is now the Kingston mineral claim. These four claims were recorded at Granite Creek, but they were not considered worth the annual assessment duty, and were allowed to lapse."

The Hedley Gazette, which, on June 6th, announced the recent transaction above mentioned, included the following in its comments:—"Nobody knows much of the value of the property except the purchasers, who doubtless have evidence from their underground workings, though it was a comparatively easy matter to arrive at the conclusion that their situation meant much. This was apparent as soon as work was resumed in No. 4 tunnel of the Nickel Plate and ore extraction and development have gone on so extensively since then. What it means for this camp is simply this: it has most effectively exploded the old theory that the Hedley Gold Mining Company had within its 20 odd claims all that was of value in the camp." The Gazette further stated that the purchase price is $150,000.

The Blue Bell Mine, Kootenay Lake.

While little is being published concerning what is being done at the old Blue Bell lead-silver mine, situated opposite Ainsworth, on the eastern shore of Kootenay Lake, it is known that good progress is being made with the installation of new plant and machinery requisite for the development of the mine below its main adit level, and enlargement of the capacity of its concentrating mill.

The Blue Bell has a noteworthy history, dating back to its discovery in 1825 by David Douglas, a Scottish botanist, who was investigating flora of the Kootenay Lake country. In the sixties the late Senator Hearst, of California, endeavoured to turn its ore to profitable account, but failed, and then in the eighties Dr. Hendryx and his Minnesota and Connecticut associates organized the Kootenay Mining and Smelting Company and acquired the property, in connection with which, about that time there was the quarrel between Hammill and Sproule, which resulted in the latter shooting the former and afterwards being hanged for the crime. Eventually the property passed to the possession of the Bank of Montreal. In 1905 it was purchased from the bank by the Canadian Metal Company, Ltd., and now it is owned by the New Canadian Metal Company, of which Mr. S. S. Fowler is general manager.

Figures showing the aggregate output of ore from the Blue Bell mine are not at present available, but it is known that there was shipped to the old smeltery at Pilot Bay during fifteen months ended March 31, 1896, 67,185 tons. During 1906 more than 10,000 tons was shipped by the Canadian Metal Company, also to Pilot Bay. By June, of 1908, the concentrating mill near the mine was completed, and between then and March, 1910, approximately 90,000 tons of ore was milled there. Reorganization of the Canadian Metal Company, which is a French proprietary, took place in 1911, and early in 1912 the work now being proceeded with was undertaken. There is still much ore in the mine, so it is expected that production on an important scale will be continued for a long time after the improvements now in hand shall have been completed.

Boundary District Notes.

From the Phoenix Pioneer it is learned that the Phoenix Mining, Smelting and Development Company has let a contract for development work to be done on the Duncan group of mineral claims, situated near Beaverdell, on the west fork of Kettle River, and recently bonded by that company. Silver-lead ore of good grade was shipped from this group in 1909.

The Riverside Mining Company, now that its Riverside mine, situated on Kettle River, a few miles above Rock Creek, has been connected with the railway by a spur, will ship ore to the Granby smeltery at Grand Forks. For the present it is intended to ship three carloads a week. The development of the mine was continued throughout last winter.

The quantity of ore produced by Boundary district mines during five months to June 1 was about 825,000 tons, of which approximately 483,000 tons was from the Granby Company's mines, and 342,000 tons from those of the British Columbia Copper Company.

According to the Boston Commercial, Mr. Newman Erb, president of the British Columbia Copper Company, had issued a formal statement to the effect that the executive commiteee would recommend to the directors at the next meeting of the board the resumption of payment of dividends at the rate of three per cent. (15 cents a share) quarterly only. The company is stated to have enough cash and metal in transit to pay a full year's dividend at that rate. The production of copper in May was 1,054,000 lbs., which was the largest output for any single month in the history of the company. Net earnings for May are reported as having been $58,000.

From the Commercial it is also learned that the Granby Company will not begin construction work on the proposed new smeltery at its Hidden Creek property, on Observatory Inlet, until it has opened by underground workings, the large ore body which the diamond drill indicated contains considerable two per cent. ore. This work will take from four to five months to do.

General Mining Notes.

At the end of May the long low-level cross-cut tunnel being driven at the Slocan Star mine, near Sandon, Slocan, was in about 1,200 feet.

A long cross-cut tunnel is being driven at the Britannia mine, near Howe Sound, New Westminster mining division. When this shall be completed, ore will be conveyed from its portal down to the concentrating mill at Britannia Beach over an electrically-operated tramway.

The British Pacific Coal Company has been inviting tenders for an aerial tramway from the pitmouth to tidewater, the buckets to be suitable for conveying coal. A capacity of 300 tons in ten hours was to be provided for. Bids have also been asked on construction of a pier, or a loading wharf, and a bunker, at Skidegate Inlet, Graham Island, Queen Charlotte group.

The report that the Red Cliff Mining Company, which is developing a copper property in Portland Canal mining division, about a dozen miles from Stewart, had obtained an option on a controlling interest in the shares of the Tyee Copper Company, Ltd., has been confirmed by news from London, England. The Tyee smeltery at Ladysmith, Vancouver Island, has two blast furnaces of modern type, and is otherwise well equipped for smelting copper ore.

Production of Rossland mines during the first five months of 1912 has been at an average of rather more than 20,000 tons a month of ore. Of this output, a total of approximately 97,000 tons for the whole period has been received at the Consolidated Mining and Smelting Company's smeltery at Trail. A comparatively small quantity was put through the Le Roi No. 2 Company's concentrating mill, which treats the ore of too low a grade for shipment to the smeltery without concentration.