Department of Colonization, Mines and Fisheries

BUREAU OF MINES
QUEBEC, CANADA

GEOLOGICAL SKETCH

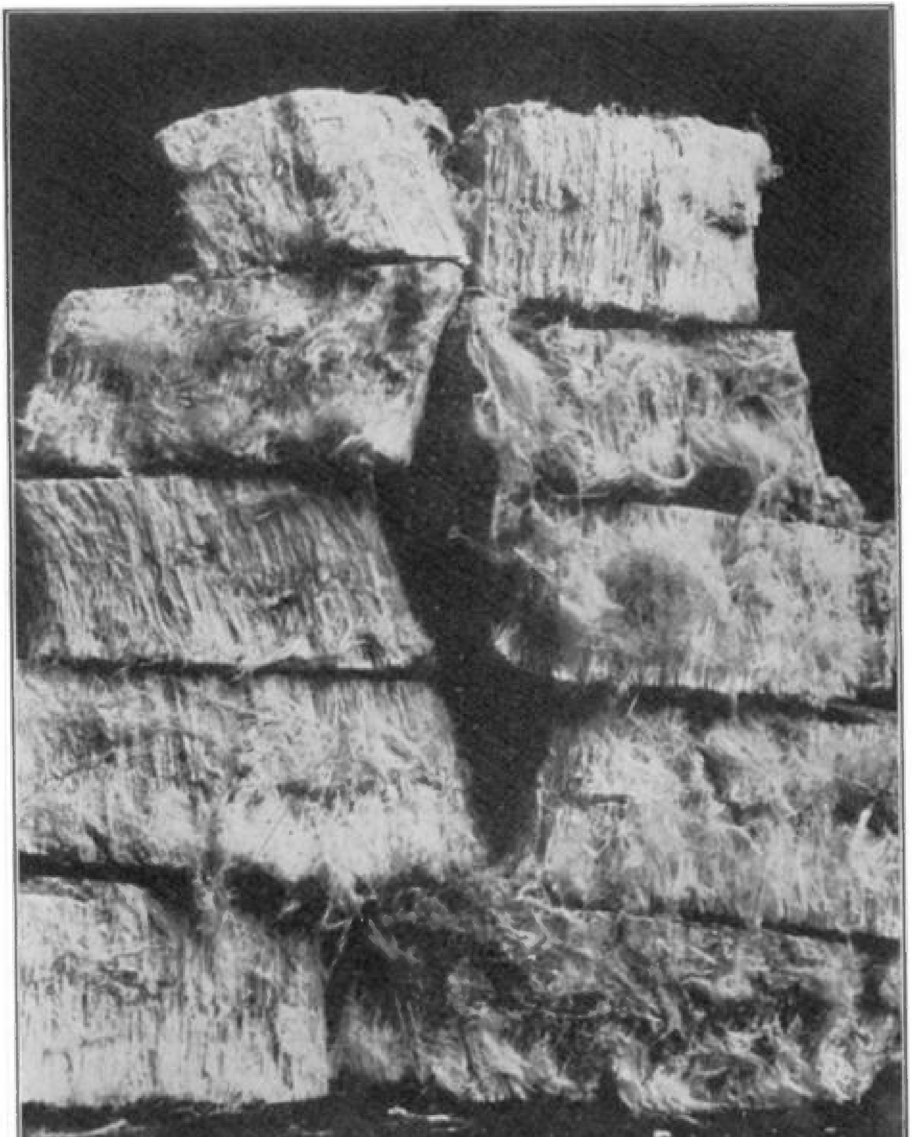
AND

ECONOMIC MINERALS

OF THE

PROVINCE OF QUEBEC

PROVINCE OF QUEBEC
CANADA
1927



Chrysotile asbestos from Thetford Mines.—Quality "Crude No. 1".
Length of fibre 4½ inches.

Geological Sketch

AND

Economic Minerals

OF THE

Province of Quebec

CANADA

A compilation of information from official sources

QUEBEC BUREAU OF MINES

Department of Colonization, Mines and Fisheries

QUEBEC, Canada.

GEOLOGICAL SKETCH

OF THE

PROVINCE OF QUEBEC

CANADA (1)

The Province of Quebec is by far the largest in the Dominion of Canada. Its extreme measurements are 1250 miles from north to south, and 950 miles east and west, and the total surface is only slightly less then 600,000 square miles. It is therefore nearly seven times the size of the kingdom of Great Britain, the area of which is 88,700 square miles, whereas the population of England, Scotland and Wales is almost twenty times that of the Province of Quebec.

In such a vast area, so thinly populated, it is unavoidable that detailed geological information should be incomplete. The main lines and the principal features of the geology of the Province of Quebec have been comparatively well established, by reconnaissance survey methods and explorations, but it is only within the last few years that systematic, detailed work has been

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* By Théo. C. Denis.

undertaken, to solve local geological problems, mostly of an economic nature. It is therefore to be expected that many changes in the outlines of formations will be made as the field-work and detailed mapping progress, and as the accumulation of additional information permits the correlation of work done in widely separated areas.

The lack of means of access and transportation has greatly militated against the detailed geological exploration, and intensive prospecting of the northern part of the province. It is quite possible to foresee that aviation may in a near future play an important part in prospecting, and that the canoe and the sturdy " portageur ", proceeding with great physical effort at the rate of twenty miles a day, may before long give way to airplanes, transporting the geologist or prospector at the rate of seventy five or one hundred miles per hour. In fact already, aerial mapping has become an important branch of the topographical survey, these methods have facilitated the mapping of vast tracts of territory within a very short time. These topographical maps will in themselves prove an invaluable aid to the geologist. The topography of the whole northern part of the province eminently lends itself to this means of transportation, for its surface is literally studded with myriads of lakes, on which hydroplanes can alight without the slightest difficulty.

The present short sketch must obviously be regarded as a mere outline ; for the details and geological descriptions of various parts of the province, reference may be had to the reports of the Geological Survey of Canada, to the publications of the Quebec Bureau of Mines and also to the series of Guide-Books which were published by the XIIth International Geological Congress, held in Canada in 1913.

As it is at present established, the generalized geological scale of the formations which have been recognized in the Province of Québec is as follows :—

Geological Systems	*Representative Formations*
QUATERNARY	Champlain clays and sands. Boulder clays.
DEVONO-CARBONIFEROUS	Bonaventure formation.
DEVONIAN	Gaspé sandstone. Grande Grève limestone and shales. Saint Alban shales.
SILURIAN	Undifferentiated Silurian. Medina shales.
ORDOVICIAN	Lorraine shales. Utica shales. Trenton limestone. Black River limestone. Chazy limestone. Levis shales and limestone. (Beekmantown.)
CAMBRIAN	Sillery shales. L'Islet, schists and quartzites. Potsdam sandstone.
PRECAMBRIAN	Keweenawan. Upper Huronian (Animikie, Cobalt). Lower Huronian (Temiscamingue). Laurentian. Grenville. Keewatin and Abitibi.

For the purpose of the description of the geology, Quebec may be divided into three main geological provinces, and it is remarkable how distinct they are from each other, and how little they overlap or encroach on one another.

I.—*The Laurentian Plateau Region,* which comprises the whole northern part of the Province to the north of the valleys of the St. Lawrence and Ottawa rivers. This embraces well over 90 per cent of the total area of the province.

II.—*The Appalachian Region,* which embraces the south-eastern part of the province, bordering on Vermont, New Hampshire, Maine and New Brunswick, and lying east of a line joining Quebec City to the foot of Lake Champlain.

III.—*The St. Lawrence Lowlands,* which include the plains bordering the St. Lawrence river above the city of Quebec, and the south-western part of the Province. It occupies a triangle the summits of which are the city of Quebec, the city of Ottawa and the foot of Lake Champlain.

I.—THE LAURENTIAN PLATEAU.

The region of the Laurentian Plateau, which comprises more than nine tenths of the whole area of the province, forms an immense plateau with an uneven rolling surface, the elevation of which varies between 500 and 2000 feet, while some of the highest spots and peaks reach and even exceed 5000 feet above sea level. To the north, the Laurentian Plateau extends as far as Hudson Bay and Hudson strait. The southern edge, which more or less follows a line joining the cities of Quebec and Ottawa and forms the north shore of the estuary of the St. Lawrence, is well marked by an escarpment, which is frequently referred to as the Laurentian Range. Except for a few outliers of later stratified rocks, such as observed in the basin of Lake St. John, and on the south shore of James Bay, all the rocks which underlie the Laurentian Plateau are very old, the oldest known. These old rocks are widely developed in the northern parts of the province of Ontario and Quebec, on both sides of Hudson Bay, and constitute the basement on which rest the later sedimentary strata of the North-American continent. It is the " Canadian Shield " of the geologists.

The rocks of the Canadian Shield are for the most part Precambrian rocks of igneous origin. The predominant ones are granites and granite-gneisses, which represent a long period of intense and widespread intrusive action of an acid magma which was very general throughout the whole of the northern part of Canada, resulting in an immense area of batholiths of granite and granite gneisses. This period of igneous activity is here referred to as Laurentian.

In this immense development of igneous rocks, are outliers and patches of other rocks, some older than the Laurentian gneisses and granites, and others younger. As a rule the rocks of these outliers and patches are dark in colour and schistose in structure. The area which each outlier covers may vary from a few square yards to hundreds of square miles. These assemblages of rocks are always highly altered and metamorphosed, but frequently can be recognized as having been of the nature of sediments, or of volcanic rocks formed on the surface. Owing to the alternance of sedimentation and volcanic activities, these patches of altered rocks may be so intricately connected with the granite and gneissic rocks of different ages, which may underlay, or penetrate them, that their relations are most complicated. Although such altered rocks belong to one or other of the subdivisions of the Precambrian, it is frequently impossible to definitely place or correlate them, and they often receive local formational names.

These rocks constitute the Keewatin, Abitibi, Grenville, Temiscamingue, Cobalt and Animikie formations of the Precambrian system, and their importance, from an economic standpoint, may be gathered from the fact, that it is within these formations that are situated the gold deposits of Northern Ontario and Northern Quebec ; the silver mines of Cobalt ; the nickel-copper deposits of Sudbury ; the iron ores of Lake Superior ; besides deposits of graphite, lead, zinc, molybdenite, mica, and others. They are as a rule, much more intensely mineralized than the surrounding Laurentian granites and gneisses, which are usually barren of economic minerals.

II.—THE APPALACHIAN REGION.

The Appalachian Region of the Province of Quebec lies to the south-east of a line joining the foot of Lake Champlain and Quebec city, and to the south of the estuary of the St. Lawrence

River, below this city. It is part of a mountainous belt, the Appalachian mountain system, in which the strata are highly folded and faulted and bearing numerous evidences of igneous activity. This system of mountains, ridges and folds, continues on in the same southern trend, into the United States, as far as Alabama. In the Province of Quebec, the Appalachian region therefore, comprises the eastern part of the Eastern Townships, the regions of Beauce, Témiscouata and Matapédia, and nearly the whole of Gaspé peninsula.

The lowest and the highest rock formations found in the Province of Quebec are both represented in the much disturbed Appalachian region. In the Eastern Townships and the Beauce district, Cambrian and Ordovician strata occupy large areas ; in the Gaspé peninsula, the Silurian and the Devonian are largely developed with small areas of Devono-Carboniferous rocks at the eastern extremity of the region. Moreover, the mountain building forces, which acting as a thrust from the east, crumpled the strata into roughly parallel ridges or folds, overthrusts and faults, and elongated bands, striking north-east and south-west, have uplifted and exposed the crystalline rocks of the Precambrian basement, more particularly along the axes of folding. This region having been the scene of violent igneous and volcanic activity we find the sedimentary rocks penetrated and invaded by bodies of acid and basic intrusives, often batholithic in their dimensions, the nature of which ranges from very acid granites to peridotites and dunites, in places altered to serpentine. The geological structure is extremely complicated.

The Appalachian region is caracterized by valuable economic minerals. The chief ones at present being worked are the asbestos deposits which are the largest known in the world ; the chromite deposits ; the copper deposits of the Sherbrooke district ; and the valuable lead and zinc deposits of the Cascapedia river, which latter, although recently discovered, have been sufficiently developed to show that they can take place among the important American deposits of these metals.

The highest rock formations known in the Province of Quebec consist of a rim of Devono-Carboniferous rocks in the Gaspé peninsula. Therefore during the geological periods which followed the upper Devonian, the whole of the Province of Quebec always remained emerging above the sea, and we do not find anywhere true Carboniferous strata. These conditions preclude the possibility of finding true coal measures within the boundaries of the Province.

III.—THE SAINT LAWRENCE LOWLANDS.

The region of the St. Lawrence Lowlands is bounded on the north by the southern edge of the Laurentian Plateau, which approximately follows a line joining the cities of Ottawa and Quebec. To the south-east it abuts against the great Champlain fault, which stretches from Lake Champlain to Quebec city. This fault separates the nearly horizontal Paleozoic strata of the Lowlands, from the highly folded rocks of the Appalachian province. Therefore the St. Lawrence Lowlands occupy a roughly triangular area the apexes of which are respectively Quebec city, Ottawa, and the foot of Lake Champlain.

The district in question is almost wholly underlain by strata of Ordovician age, lying horizontally or very gently dipping. Owing to the local character of the lowlands, and the undisturbed character of the rocks the superficial deposits are thick, and outcrops are unfrequent. It is therefore difficult to plot with any degree of accuracy, or even approximately, the outlines of the formations. The total thickness of the Ordovician system is very great ; in the neighbourhood of the city of Montreal there are 4,350 feet of strata from the base of the Potsdam to the highest members of the Lorraine there exposed.

The plain of the St. Lawrence Lowlands is characterized by a uniformity of level, and it may be called quite flat. But this uniformity is broken by several hills of igneous rocks, which rise abruptly from the level plain, and constitute striking features of the landscape. They are a series of plutonic intrusions, mostly of the neck type, and they represent the substructure of volcanoes, which at one time were in active eruption in the region.

There are eight of these hills in a stretch, from Mount Royal the westerly one, to Shefford Mountain the most easterly. They vary in height from 715 feet to 1,775 feet. The best known of these is Mount Royal (770 feet) at the foot of which lies the city of Montreal.

GLACIAL AND MODERN DEPOSITS.

At the close of the Devonian period, practically the whole of the Province of Quebec had emerged above the level of the ocean, and remained uplifted and uncovered by water during the succeeding geological ages. Therefore not only did no sedimentation take place over the area which now constitutes our Province, but the whole surface, was subjected to continuous erosion and denudation, both atmospheric and fluviatile, from the Devonian to the close of the Glacial period. Hence the absence of Carboniferous and Permian, as well as of all Mesozoic and Tertiary rocks.

The geological period which immediately preceded the present or modern, is the Glacial period. Duding this period the whole of what constitutes the Province of Quebec was covered by a thick sheet of ice. This huge glacier, the front of which reached south into the states of New York, Pennsylvania, Ohio, Wisconsin, crept slowly but continuously and its gathering ground was the central part of the Labrador peninsula. This is designated as the Labrador Ice Sheet. At its center of distribution the ice sheet measured a thickness which has been estimated by various geologists at from 12,000 to 40,000 feet.

At the close of the Glacial epoch there was a subsidence which resulted in an invasion of the sea along the valleys of the St. Lawrence and Ottawa rivers. Moreover the retreating ice-front of the glacier impounded or dammed the waters, in an unbroken line to the north and this gave rise to the formation of large sheets of water until the ice-front had sufficiently retreated to allow drainage by the way of Hudson Bay. During this period of submergence heavy mantles of marine clays and sands were deposited which in the Province of Quebec attain the greatest development in the Lowlands region, south-east of the St. Lawrence river. The clay which is heavy and usually blue in colour, is called Leda clay, from a very prevalent marine shell found in it. Large deposits are observed along the shores of the St. Lawrence river, as well as in Montreal city itself. The sand, large banks of which are seen along the north shore of the river, is the Saxicava sand. This period which immediately followed the Glacial epoch, is usually referred to in Eastern Canada as the Champlain period, and the sea which submerged the southern part of the province as the Champlain sea.

Shore lines of the Champlain sea have been observed on the flanks of elevations rising above the St. Lawrence plains, which show that the level of the region between Montreal and Quebec stood, during the Champlain subsidence, some 600 feet lower than at present. Differential uplift movements subsequently raised the sea floor, with the deposited sediments, to the present level.

BRIEF DESCRIPTIONS OF THE GEOLOGICAL FORMATIONS FOUND IN THE PROVINCE OF PROVINCE

PRECAMBRIAN.

Keewatin.

The Keewatin, or Abitibi rocks, well developed in northern Quebec, in the Laurentian shield, consist of dark coloured volcanic rocks, such as basalts, andesites, as well as more acid lavas, dacites and rhyolites, and coarse volcanic breccias or tuffs. The rocks of the Keewatin are mostly dark olive-green in colour, and massive, with pillow structures well developed and widely present.

Grenville.

This term is applied to a series of deeply metamorphosed sedimentary rocks, completely recrystallized, which occupy large areas in the Ottawa and St. Lawrence rivers. They are characterized by (1) large occurrences of crystalline limestone, usually magnesian, and passing to magnesite ; (2) metamorphosed shales and sandstones, which are now sillimanite-garnet gneisses and vitreous quartzites.

Laurentian.

Granites and granite gneisses. These are acid intrusive rocks, widespread, which occupy the greater part of the Laurentian Plateau. These acid rocks belong to various periods of intrusions, many of which are post-Temiscamingue, but all have been grouped in this series.

Temiscamingue Series.

The term Huronian in the old nomenclature included the altered sedimentary rocks between the Laurentian and the Keweenawan. The Temiscamingue series is the lower group of these rocks and comprise metamorphosed conglomerates, greywackes, quartzites and slates. The Temiscamingue series was greatly invaded and intruded by various porphyries, gabbros, granites and diabases, and there is a great unconformity between the Temiscamingue series and the next one, the Cobalt series.

Cobalt Series.

The rocks of the Cobalt series are conglomerates, greywackes, and impure quartzites, in unconformable contact with the older Temiscamingue rocks. This series derives its name from the Cobalt district where it contains the greater proportion of the silver deposits of that region.

Keweenawan.

Sills of diabase and olivine diabase.

CAMBRIAN.

Potsdam.

The lowest member of the Cambrian is the Potsdam sandstone, which is found usually filling depressions on the surface of the Laurentian granites and gneisses. It is a sandstone, white to yellow, often almost a quartzite. It is well developed in Beauharnois, Soulanges, Vaudreuil and Two Mountains counties.

L'Islet Formation.

The rocks of this formation are best developed in the counties of Bellechasse, Montmagny, L'Islet and Kamouraska, where they occupy a belt, parallel to the St. Lawrence river, distant 8 to 12 miles from it. They are black and dark-grey schists interbedded with quartzites.

Sillery.

The rocks of the Sillery formation are sandstones, slates and shales. The sandstones are green and buff coloured, sometimes red, and are quarried as building stones. The slates and shales are red, green and mottled. Sillery rocks occupy large areas in the Appalachian region.

ORDOVICIAN.

Levis Formation.

The Levis formation corresponds to the Beekmantown beds of New York, the equivalent of the Calciferous. It consists of indurated shales, grey, green and red, and thin beds of limestone and calcareous conglomerates. Well developed at Levis, opposite Quebec city, where a thickness of 1,000 feet of strata is exposed.

Chazy.

The upper part of the Chazy consists of limestone, which outcrops widely on the island of Montreal. It is quarried as a building stone at St. Martin, Bordeaux and Mile-End. Along the Ottawa river the Chazy is represented by sandstone and shale.

Black River.

This consists of thin bedded limestone, and although the total thickness of the formation does not exceed 30 to 40 feet, it is very persistent.

Trenton Group.

This is the most persistent of the subdivisions of the Ordovician. It consists of beds of limestone, of all thicknesses, the colour rather uniformly grey-blue to light-grey. Trenton limestone is found all the way from Ottawa to Quebec and important quarries are operated on it in numerous places. It is largely developed in the city of Montreal, where its thickness is about 600 feet.

Utica and Lorraine.

At the close of the Trenton, a gradual uplift of the land took place, and the conditions of sedimentation changed. At the top, the Trenton passes to calcareous shales, followed by bituminous shale of the Utica, then by enormous beds of Lorraine shales and thin sandstones, which in places measure 2,000 feet. Most of these strata in the St. Lawrence Lowlands are very little disturbed.

Silurian.

The greatest development of Silurian rocks is in the Gaspé peninsula, along the north shore of the Baie des Chaleurs ; they outcrop without a break between Matapedia and Cascapedia rivers. Limestone predominates, with calcareous shales at the base. The section from Cascapedia to Black Cape shows a thickness of Silurian strata of 7,000 feet.

Devonian and Devono-Carboniferous.

As far as known, Devonian and Devono-carboniferous strata are confined to the Gaspé region, where they are rather widely distributed, and to the southern part of James Bay at the south end of Hudson Bay.

The Devonian in the interior of Gaspé is mainly represented by sandstones, thin limestones and shales, which stretch in a wide belt from Matapedia river to the eastern extremity of Gaspé. This belt is over one hundred miles long by a width varying between ten and forty miles. At Percé the lower beds of the Devonian are limestones of the Grande Grève formation.

Surmounting the Gaspé sandstone of the Devonian is the Bonaventure formation, the highest found in the Province of Quebec, which consists of a rim of conglomerate and sandstone to the south of the Bay of Gaspé.

The Devonian of James Bay consists in the main of beds of light yellowish limestone, which have been very little disturbed.

Igneous Rocks.

Apart from the acid and basic rocks which everywhere cut and intrude the Laurentian granites and gneisses there are three main types of intrusions in the Province of Quebec, which call for a short notice.

The series of Monteregian hills, of which mention has been made, consists of necks of igneous rocks which rise abruptly from the very level plain of the St. Lawrence Lowlands. They are eight in number, and they are the remnants, or substructure, of ancient volcanoes. They form a distinct petrographical province characterized by rocks high in alkalies, the main types of which are Nepheline syenite and Essexite.

The Appalachian region is characterized by a series of intrusions of very basic rocks consisting of peridotites, pyroxenites, gabbros, diabase, and smaller proportions of acid rocks, granites and aplites. These rocks can be followed, with breaks, from the Vermont boundary, north-easterly, to the extremity of Gaspé peninsula. The alteration of the peridotite gives rise to serpentine, and from this characteristic rock the series is called the Serpentine Belt. It is in these rocks that are found the asbestos deposits and the chromite deposits.

The third class of noteworthy igneous rocks consists of very large intrusions of " anorthosite " which penetrate the rocks of the Laurentian to the north of the St. Lawrence river. These are coarse grained plutonic intrusions of the gabbro type, but almost exclusively composed of plagioclase feldspar, of the labradorite and andesine types, which make up more than 95 per cent of the rock. The size of these intrusions may be gathered from the fact that one which has been approximately delimitated from Lake St. John eastward, occupies an area of nearly 6,000 square miles. With these large massifs are associated the ilmenite and highly titaniferous magnetite deposits of the north shore of the St. Lawrence, and of the St. Jérôme region.

ECONOMIC MINERALS OF QUEBEC (1)

INTRODUCTION.

The mineral production of the Province of Quebec, has so far been won entirely from the southern strip of the basins of the St. Lawrence and Ottawa rivers, that is to say from old established districts, which have been settled for generations. In fact it may confidently be stated that of the 600,000 square miles which constitute the province of Quebec, less than 40,000 square miles has been prospected, and may be said to be approximately well known, from the standpoint of the mineral occurrences ; there are yet big prizes in the Province of Quebec awaiting the mineral explorer and the prospector.

It is also interesting to note that, so far, the great bulk of the minerals produced by the Province of Quebec has been of the non-metallic class, such as asbestos, mica, feldspar, magnesite, as well as practically all the building materials, granite, limestone, marble, brick, cement and others. While not so spectacular as the production of the precious and other metals, they nevertheless form the foundation of a sound mineral industry.

The Laurentian Plateau, it has been stated, constitutes more than 90% of the total area of the province. The rocks of this plateau, which extend west and north-west, into Ontario, Manitoba, Saskatchewan and the North-West Territories, are the oldest in the world. They have been greatly altered and metamorphosed and are widely mineralized. They contain gold, silver, lead, nickel, copper, iron, zinc, phosphate, mica, feldspar, graphite.

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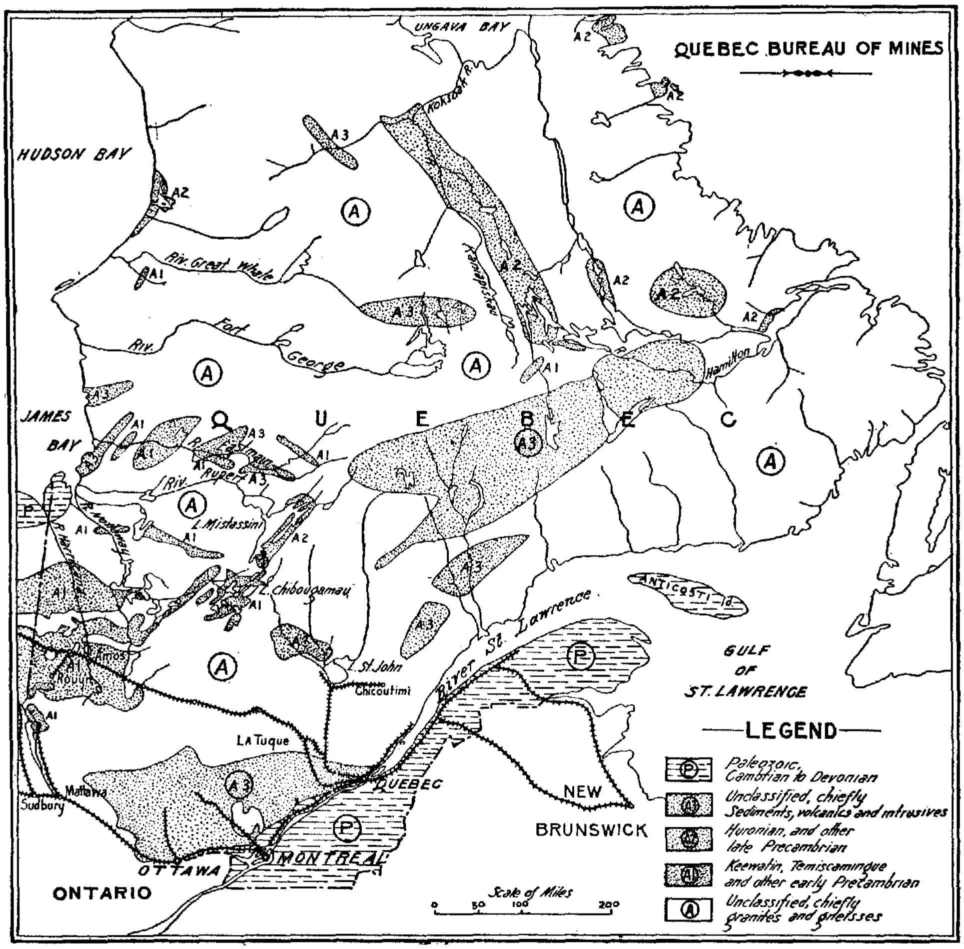
* By Bertrand T. Denis.



Sketch map of the Province of Quebec, showing relative distribution of Precambrian rocks (A, A 1, A 2, A 3) and of Paleozoic rocks (P).

In the vast Laurentian shield, which on the geological map is coloured pink of various shades, numerous areas of rocks of Keewatin, Grenville, Temiscamingue, Huronian and Animikie formations have been observed, all the way from the St. Lawrence and Ottawa rivers northwards to Hudson Strait. It is in rocks of these formations that are found the celebrated gold and silver mines of Ontario, the nickel and copper mines of Sudbury, the immense iron mines of the Lake Superior district in the United States, the gold-copper deposits of the Abitibi region.

There are yet great areas underlain by rocks of these formations, (marked A1, A2, A3 on the sketch map, p. 17) which are unprospected, and which should be considered as possible mineral producers.

To the south of the St. Lawrence river, stratified beds of Paleozoic age predominate, embracing sedimentary rocks of Cambrian, Calciferous, Chazy, Trenton, Utica and Lorraine formations, as well as Silurian and Devonian beds in Gaspé. They comprise limestones and sandstones which furnish excellent buildings stones ; shales and slates which supply roofing slates and materials for the manufacture of bricks and clay products. These stratified rocks are, in numerous places, penetrated and intruded by rocks of igneous origin like the granites of Stanstead and Frontenac counties which yield stones for monuments and for building, and like the olivine intrusions, or serpentine belt, which traverse the counties of Brome, Shefford, Richmond, Wolfe and Megantic and contain asbestos, copper, chrome and gold.

The fact that no true Carboniferous or later strata are found within the boundaries of the province of Quebec precludes the possibility of the discovery of true coal measures in the province.

The progress of the mineral industry in the province of

Quebec during the past 30 years is revealed by a glance at the following table giving the value of the annual production.

Year	Value	Year	Value
1898	$1,673,337	1912	$11,187,110
1899	2,083,272	1913	13,119,811
1900	2,546,076	1914	11,732,738
1901	2,987,731	1915	11,765,873
1902	2,985,463	1916	13,287,024
1903	2,772,762	1917	16,189,179
1904	3,023,568	1918	18,707,762
1905	3,750,300	1919	20,813,670
1906	5,019,932	1920	28,392,939
1907	5,391,368	1921	15,522,988
1908	5,458,598	1922	18,335,153
1909	5,552,062	1923	21,326,314
1910	7,323,281	1924	18,952,896
1911	8,679,786	1925	23,824,912
		1926	25,750,463

It may be seen that within this space of time the yearly output has advanced from about $1,600,000 to $25,750,000 and moreover that, with the exception of the economically unsettled period at the end of the war, the progress has been very steady and continuous.

The table on page 20 gives the itemized mineral production of the province of Quebec for the year 1926, and the values for 1925.

The overwhelming preponderance of non-metallic products is probably the most striking feature of this table. In fact the value of the non-metallic products was $23,800,000 or over 90% of the total production. Building materials, it may be noted, constitutes over half of the total value of the year's production.

TABLE OF THE MINERAL PRODUCTION OF THE PROVINCE OF QUEBEC 1926

SUBSTANCES	Quantities	Value in 1926	Value in 1925
Asbestos, tons . . .	279,389	$10,095,487	$8,976,645
Copper ore, tons . .	8,233	368,886	277,083
Feldspar, tons . . .	13,168	111,136	94,730
Gold, oz.	3,679	76,070	37,909
Graphite, tons . . .	326	29,516	40,792
Magnesite, tons . . .	9,130	137,431	122,325
Mica, lb.	3,327,695	170,118	200,512
Mineral paints (iron oxide, ochre) tons . . .	6,517	100,923	89,173
Mineral water, gal. . .	6,956	2,444	9,302
Molybdenite, lb. . .	20,943	10,472	11,176
Phosphate, tons . . .	40	800	
Pyrites, tons	14,100	42,117	
Quartz, silica rock, tons	26,099	109,564	30,064
Silver, oz.	375,986	233,513	165,974
Talc, soapstone, tons .	885	38,209	30,130
Titaniferous iron ore, tons	200	600	11,934
Zinc and Lead ore, tons	20,415	1,207,987	530,112
Sub-total .		$12,735,273	$11,949,851
BUILDING MATERIALS			
Brick, M.	139,371	2,256,856	2,017,999
Cement, bbls . . .	3,727,477	4,535,386	5,689,992
Granite, tons . . .	504,733	873,962	1,356,038
Lime, bushels . . .	2,852,279	756,117	673,164
Limestone, tons . . .	1,679,775	2,180,977	2,215,502
Marble, tons	6,676	519,032	276,075
Sand, building, tons .	5,475,847	1,452,574	576,105
Sandstone, tons . . .	26,806	48,937	83,297
Tile, drain and sewer pipe, potery, etc., . .		381,088	308,880
Sub-total .		$13,004,929	
Total . . .		$25,750,463	$23,824,912

Attention is drawn to the fact, however, that this table does not reflect exactly the present status of the mineral industry in the province of Quebec. The reason is that the effects of the great activity recently displayed in new fields, such as Rouyn and Gaspé, do not appear in this table, for the recently discovered metalliferous deposits of these regions are still in the development stage and are not yet producing.

That a great interest in prospecting is being shown is at once apparent from the next table in which are listed the various titles issued by the Bureau of Mines during the past six years.

	Miners Certificates issued	Claims Recorded	Mining Licences in force	Mining Concessions made
1920-21	493	335	212	5
1921-22	509	321	195	4
1922-23	1973	1183	238	8
1923-24	1928	1750	635	9
1924-25	2239	5143	1045	17
1925-26	3315	9407	1074	8

By far the greater number of these claims have been staked in northwestern Quebec, and some important ore bodies have been blocked out. In a very short time the province of Quebec should take a place among the important metal-producing provinces of Canada.

The situation at the present day as regards the mineral production in the Province of Quebec may therefore be resumed as follows :

(1) There is a total production of about $25,750,000, almost exclusively of non-metallic products.

(2) There are most promising metallic deposits, partly developed, on the point of reaching the producing stage.

(3) With the great potentialities of metallic resources in the Laurentian Plateau the prospects of Quebec mining industry are of the brighest.

The various economic minerals, ores and metals which are known to occur in the province of Quebec will be taken up and briefly reviewed, in alphabetical order under the main headings of Metallics and Non-Metallics.

As a measure of the economic importance of each particular mineral the official production figures for the last three years have been given.

Market prices are also quoted for the various products ; these are of course only approximate. However it is often useful to know whether a material is worth ten dollars per ton or ten dollars per pound, and the figures given will give the interested reader some conception of the market value of the minerals found within the boundaries of the province of Quebec.

METALLICS

Aluminium.

Although the province of Quebec does not produce ores of aluminium such as bauxite and cryolite, the development of large water powers on the St. Maurice and Saguenay rivers has attracted several electro-metallurgical industries which require abundant and cheap power, among which prominently figures aluminium

The importance of cheap power for the reduction of alumina to metallic aluminium may well be realized from the fact that one horse-power-year is required to produce 500 pounds of the metal.

The Northern Aluminum Company operates a reduction plant at Shawinigan Falls, on the St. Maurice river, situated half way between Montreal and Quebec. This plant has an output capacity of twenty million pounds of aluminium per year.

Besides the reduction plant, the Northern Aluminum Company, which is allied to the Aluminum Company of America, has large works at Shawinigan, where the metal is manufactured into ingots, alloys, rod and wire. The company also operates a plant at Toronto which turns out aluminium sheets, castings, stampings and fabricated articles.

The ore used is bauxite mainly from the southern states of Arkansas and Georgia, which is first treated or refined, at St-Louis, Missouri.

In the Saguenay-Lake St. John region, at Arvida, the Aluminum Company of Canada, a subsidiary of the Aluminum Company of America, has recently completed the first unit of a plant for the reduction of alumina to aluminium ; the first pouring of aluminium was made in July 1926.

The power used at the Arvida works is at present being supplied by the Duke-Price power plant at Ile Maligne, but construction has been started on a vast project of power development which calls for the installation of ten turbines, of a capacity of 80,000 H. P. each, or a total of 800,000 H. P., at Chute à Caron, 25 miles below Ile Maligne. The plant will probably be completed in two or three years, and it is the intention of the company to erect eventually aluminium reduction works which will be the largest in the world.

The location of the plant is such that particularly favourable transportation facilities are assured. It is situated on the Quebec and Lake St. John line of the Canadian National Railways and is, moreover, within comparatively short distance of a deep water port, open seven or eight months of the year, at the head of ocean navigation on the Saguenay river.

The ore is bauxite from Arkansas, Tenessee, and South America. It is refined at East St. Louis. It is, however, quite likely, that a refinery will be erected in the Lake St. John region to treat the crude bauxite which could be shipped directly from British Guiana where the company holds important concessions, and which will eventually be the main source of ore for the manufacture of aluminium in North America. The output of metal could, of course, also be shipped by water.

Antimony.

The presence of antimony minerals has been observed in several places in the province of Quebec, but apparently in most cases offering only a mineralogical interest. In one place only has an antimony occurrence led to considerable mining work. In the township of South Ham, on lot 28, of range I, a vein of blueish quartz, reaching in places a thickness of six feet, contains needles of sulphides of antimony, which at times are aggregated into pockets. The ore contains stibnite, kermesite, senarmontite and valentinite. Work was begun on this deposit in 1863 and continued irregularly until 1886. The workings consist of two shafts 60 and 100 feet respectively and a drift some 70 feet. A cross-cut was driven into the hill side which cuts the 100 ft. shaft.

It is said that 180 tons of antimony ore was shipped in the early days, from these workings. All work has been abandoned since 1886.

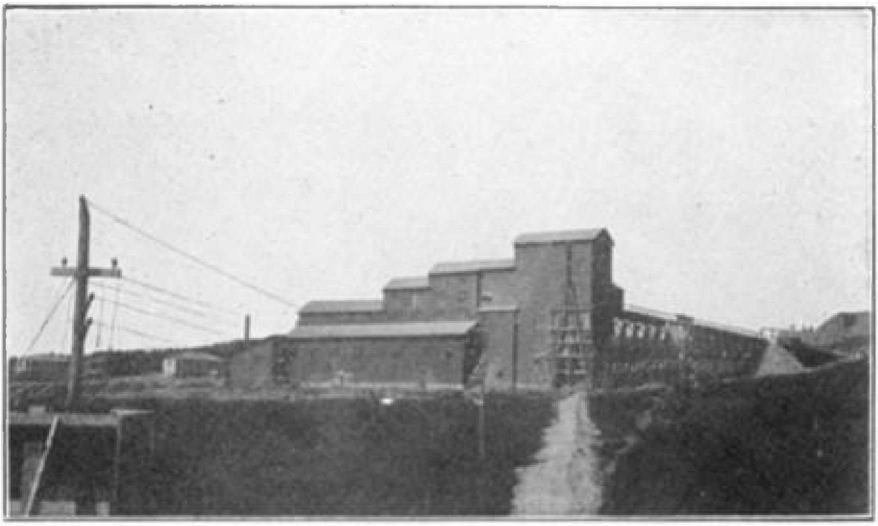
In Bonventure county, in Gaspé, a small quartz vein, has been observed, carrying stibnite. The vein however is too narrow to be of economic interest.

Bismuth.

Native bismuth and bismuthinite are found associated with molybdenite deposits in Preissac township, in Abitibi county ; also near Jonquière in Lake St. John district, but only in small quantities.

Chromite.

The only workable deposits of chromite known in Canada are situated in the province of Quebec, in the serpentine belt, which also contains the largest deposits of chrysotile-asbestos known in the world. The center of the Quebec chromite industry is the township of Coleraine, in the county of Megantic. The deposits occur in lenses or pockets, varying in size from a few inches in diameter to one hundred feet or more. One of these bodies measured 80 feet in length, the width varying between 5 and 50 feet, and it was worked in depth to 340 feet. Another was worked by an open cut which measures 100 ft. by 50, with a maximum depth of 60 feet. The rock in which these lenses are enclosed is peridotite, or sometimes serpentine, which is an alteration of the peridotite. Disseminated grains of chromite, and small nodules, are found throughout the entire serpentine belt, which development of intrusive rocks is more fully described under the heading of Asbestos.



Chromite concentrating mill in Coleraine township.

Molybdenite.—Concentration plant at Quyon, Onslow township.

From 1894 to 1908, the chromite industry of the Coleraine district was quite active. The main shipments were made from Chrome Siding, a station on the Quebec Central Railway, half way between Quebec and Sherbrooke. But the discovery of the large chromite deposits of Rhodesia, as well as the renewed activities in New Caledonia, had a very depressing effect on the Quebec chrome industry, and between 1910 and 1914 the shipments dwindled down to a few hundred tons. In 1912 and 1913 the mines were closed down altogether. But with war needs there was a resumption of activity and the banner year was attained in 1918, when 36,131 tons valued at $770,195, was shipped from the reopened mines. With the end of the war came a reaction, production decreased rapidly and since 1925 no work of any kind has been done in the chromite mines.

Prices paid for chromite are of the order of $20 per ton.

Copper.

Until recently copper mining in the province of Quebec had been restricted to that part of the province south of the St. Lawrence river, in the Eastern Townships where some of the earliest settlements of Canada were established.

Within the last few years, however, important discoveries of copper ores have been made in the western part of the Province, in the Rouyn area ; promising occurrences have also been found in the Gaspé peninsula. It would seem, therefore, that the province of Quebec may yet furnish a notable proportion of the Canadian production of this metal.

EASTERN TOWNSHIP DEPOSITS.

The beginnings of the copper mining industry in the Eastern Townships date back to 1847, and, between 1861 and 1865, during the civil war in the United States, the rapidly increasing price of this metal gave a great stimulus to copper mining in Quebec.

Copper mining operations were carried out in the counties of Brome, Shefford, Drummond, Richmond, Sherbrooke, Wolfe and Megantic. The widespread occurrence in this district is well shown by the fact that the Geological Survey of Canada report for 1866 gives a list of some 600 locations where the presence of copper minerals has been observed. The great majority of these occurrences do not, however, offer an economic interest. The list is to be regarded as a guide, and not as an enumeration of copper deposits.

During 1926 production from this district was 8,233 tons of copper concentrate and 14,100 tons of pyrite for the manufacture of sulphuric acid, having a total value at the mine of $411,0003.

Owing to the development of large deposits of native sulphur in Texas and Louisiana during the last ten years, the demand for pyrite, as a source of sulphur has gently diminished, and the imports of Spanish pyrite into the United States are now less than one third of what they were before the war.

The Eustis Mining Company, which is responsible for the total 1925-1926 production of copper and sulphur ores in Quebec has been in operation since 1865 with few interruptions. Eustis mine has produced more than one and a half million tons of ore, which contained 42% or more of sulphur, and from 2 to 8% copper. The sulphur content has been used for the manufacture of sulphuric acid and the cinder resulting from this operation has been smelted for copper. The mining is at present concentrated at the 3700 foot-level. This depth is exclusive of the part of the shaft above the tunnel which is now the exit of the mine, so that the main workings are now 4200 feet down the inclined shaft.

Geology of the Deposits.—The area within which these deposits are found forms part of the region affected by the Appalachian system of folding and faulting. The copper deposits are associated with more or less highly altered igneous rocks. Three distinct types of deposits have been recognized. 1) Deposits of chalcopyrite, bornite and chalcocite, in magnesian limestone of Ordovician age, and in chlorite schists. These owe their origin to replacement and impregnation, and were formed by the circulation of copper bearing solutions. The Acton mine, Range III, lot 30, Acton, which was formerly an active producer, was exploiting a deposit of this type.

2) Lens-like ore bodies, arranged in échelons, in schistose volcanics, and composed of almost solid pyrite, containing a little chalcopyrite. Some of these deposits are of great size. One of them is the Eustis mine, which has already been mentioned. Another large deposit of this type has been worked by the Weedon Mining Company at Weedon. The Weedon ore body possesses the largest dimensions of any single lens that has, as yet, been discovered in the district, it is 570 feet long and about 50 feet in maximum thickness.

3) The third type of deposit consists of pyrrhotite as the main sulphide, with a little chalcopyrite. This type of deposit is less important from an economic point of view and has furnished no producing mines. The reason for this is that the pyrrhotite cannot compete with pyrite, which contains a higher percentage of sulphur, while the copper content is, on the whole, too low.

THE GASPÉ DEPOSITS.

Two areas in Gaspé are known where deposits of copper have been found. The first is situated near Matane, on the north shore of Gaspé ; the second is in the interior of Gaspé peninsula. at the head-waters of the York river.

The Matane deposits contain native copper as well as chalcopyrite and pyrite. They are associated with dark basic volcanic rocks. These occurrences are interesting, but so far attempts to mine them have not been successful.

The York river deposits are of contact metamorphic origin. They are associated with the intrusion of quartz porphyries into Palaeozoic sediments (mostly limestones) and fragmental volcanics (tuffs). These quartz porphyries are considered to be offshoots of a granitic batholith underlying the central part of Gaspé. Although no workable ore bodies have as yet been found the geological conditions offer excellent chances to the prospector whose attention should particularly be directed to the zones surrounding these intrusive masses.

PAPINEAU COUNTY OCCURRENCE.

Copper bearing minerals have been noted in Petite Nation Seigniory, Papineau County. The rocks of the region are Precambrian and belong for the most part to those types which, because of their highly metamorphosed condition are grouped together as constituting a basal complex. They consist of crystalline limestone and quartzite of the Grenville Series intruded by and included in pyroxenic gneiss belonging to the Buckingham series.

The mineralization is disseminated through the pyroxene gneiss and is most abundant in the coarser and more quartzose phases. The average percentage is low, probably less than 1%. The extent of the deposit has not been determined.

THE ROUYN DEPOSITS.

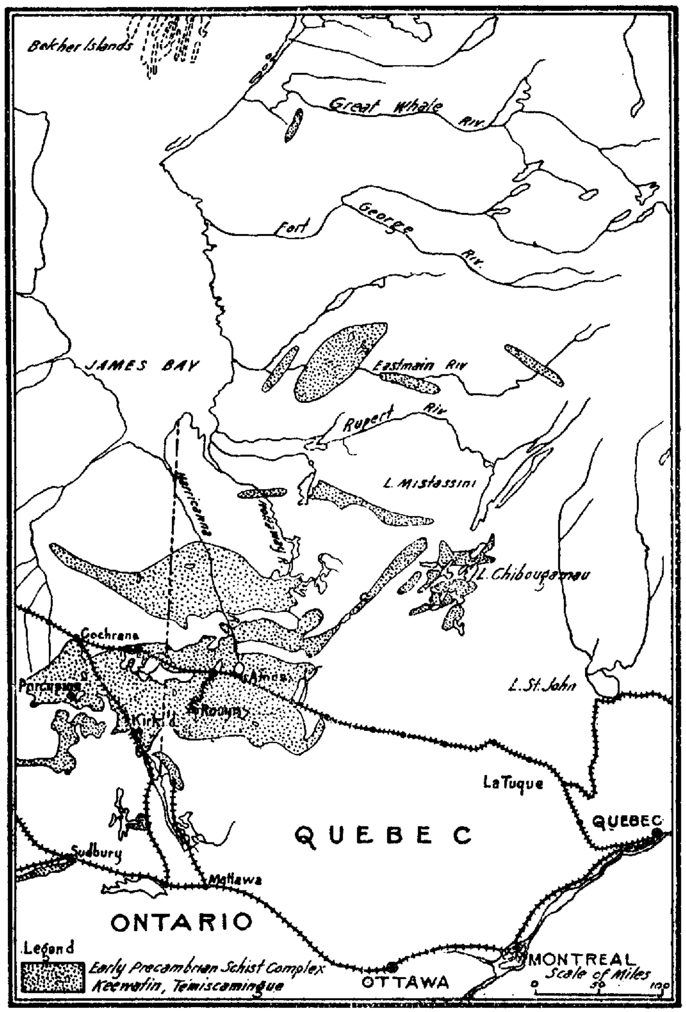
The Rouyn deposits occur in the western part of the Province of Quebec, in the mineralized development of rocks of the Keewatin, Temiscamingue, and Cobalt formations which is cut by the interprovincial Ontario-Quebec boundary. The important gold deposits of Porcupine and Kirkland lake occur in that part of the same formation which lies in Ontario.

In past reports of both the Quebec Bureau of Mines, and of the Geological Survey of Canada, attention has repeatedly been drawn to the existence of geological formations, likely to contain mineral deposits of economic value in that part of the Province of Quebec lying between the Ontario boundary and the Bell River. It was not, however, until 1922 that a considerable rush of prospectors was started, attracted by the discovery of gold quartz veins in the townships of Boischatel and Rouyn. This was followed, in the fall of 1923, by the development of a body of solid sulphides, rather unpromising at the surface, but which soon in depth proved rich in copper and gold. This was the Horne claim in Rouyn township, acquired by the Noranda Mines, Ltd., and which is now the most important deposit as yet discovered in the region. The succeeding years have witnessed a steadily increasing interest in the area, which promises to become an important and extensive mining district.

The greatest prospecting activity has been displayed in the townships of Dasserat, Boischatel, Rouyn, Joannès, Bousquet, Cadillac, Malartic, Fournière, Dubuisson, Bourlamaque, Louvi-

 Courtesy Fairchild Aerial Surveys Co. (Can.) Ltd . Grand'Mère, Que.

Rouyn and Dufresnoy townships, showing Edward lake, Rouyn Townsite, Tremoy lake and Dufault lake.



Map showing the extent and distribution of the early Precambrian Schist complex.

court, Montbray, Duprat, Dufresnoy, Cléricy, Duparquet and Destor. These townships constitute the region contiguous to the county line between Temiscamingue and Abitibi.

Other townships situated immediately along the Transcontinental Railway, Desmeloizes, Guyenne, Trécesson, Dalquier, Figuery, Landrienne and Barraute have also been receiving attention from the prospectors.

The field of prospecting has, moreover, been considerably extended, and discoveries of important mineral occurrences at points far distant from the main camp of Rouyn seem to justify the confidence of those who believe in the existence of mineral deposits wherever are found Keewatin rocks. The geological sketch map, on page 17, indicates in stippling the distribution and extent of early Precambrian schist complex, mainly Keewatin and Temiscamingue rocks, which affords an interesting field to the prospector.

These rocks are : (1) Fine grained, dark green to black, rocks of the Keewatin formation, consisting of volcanic rocks, thick lava flows, sheets of basalts, andesites, porphyries, usually deeply altered and metamorphosed ; (2) Sedimentary rocks, conglomerates, sandstones, limestones, altered to quartzites, slates and other metamorphosed rocks of the Temiscamingue formations; (3) Dark coloured coarse-grained igneous rocks, diabases, diorites, gabbros, norites ; (4) Sedimentary rocks, conglomerates, quartzites and slates of the Cobalt series.

The mineral deposits have not yet been sufficiently studied to permit their definite classification. The ores may be grouped under three general headings ; (a) Copper-zinc-gold ores, constituted by irregular masses of chalcopyrite, pyrite, pyrrhotite and zinc blende, apparently connected with the dark intrusions cutting the Keewatin, as for instance at the Horne mine ; (b) Gold-bearing pyritic ores in schisted zones, rich in quartz, carbonates and pyrite, occurring in the acid rocks of Keewatin age, as on the Arntfield claims, or in quartz lenses with copper sulphides as at the Stabell Mine ; (c) Arsenical pyrites and pyrite with native gold, in blue gray quartz in the Temiscamingue sediments as at the O'Brien mine in Cadillac.

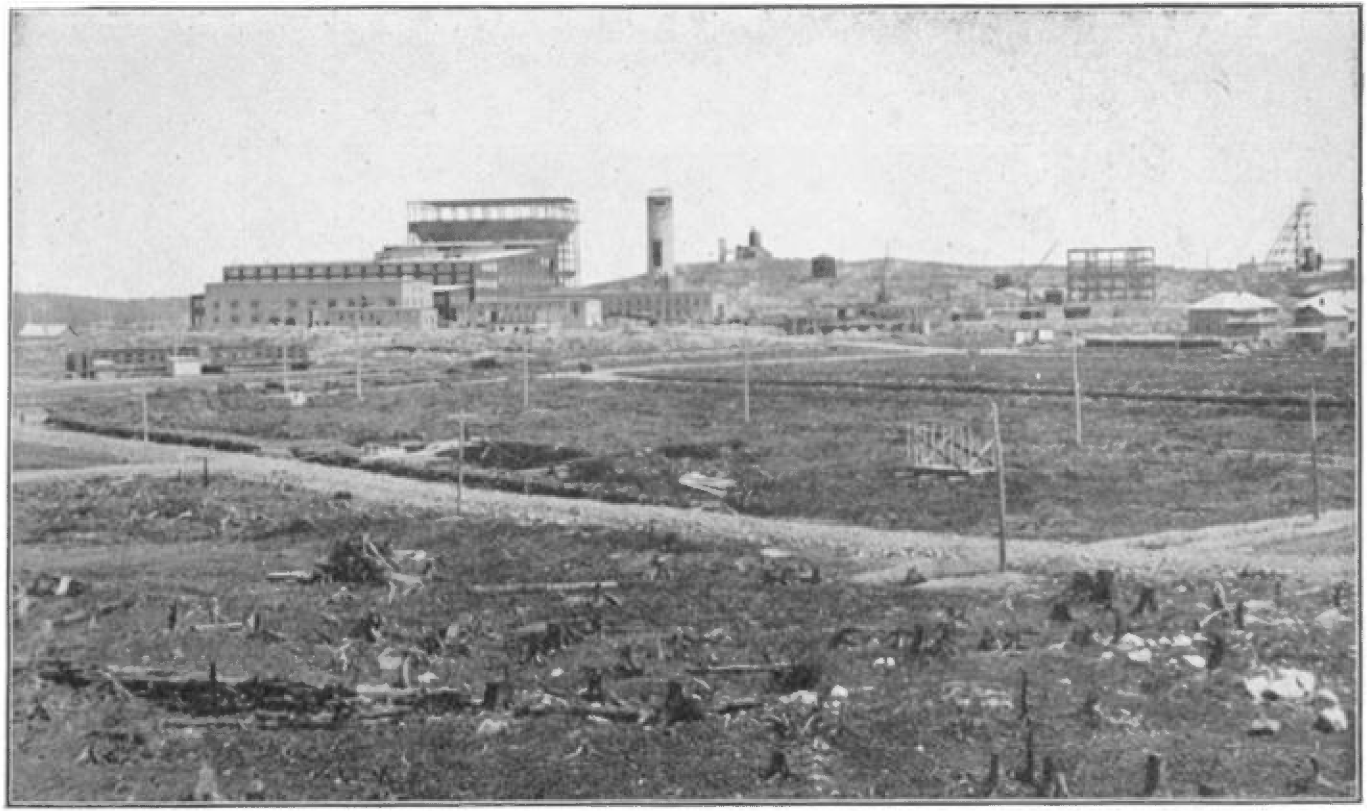


Photo Vavasour & Dick, Rouyn.
Horne Copper Corporation Ltd.—Noranda smelter in construction at Noranda. Head frame of Horne mine at extreme right

Provincial Government road from Macamic to Rouyn.

The deposits grade from the irregular lenses of the replacement type, the Horne mine at Rouyn for example, to the true fissure vein type, such as the Powell vein also in Rouyn. Intermediate types partaking of the characteristics of both replacement deposits and fissure veins are represented. The Arntfield claims are in this class.

It has been noticed, nor is it surprising, that the dark basic rocks lend themselves better to the formation of large replacement deposits than the more acid, lighter coloured, types, where the mineralization is liable to be localized in fractures in the rock.

There are as yet no producing mines, but development work is being intensively pushed on various properties, and results have justified the erection of a 1000-ton smelter which will treat ores from the whole district.

Recently a branch line of the Canadian National Railways has been completed from Taschereau into the heart of the Rouyn area. This line operating under the name of the Northern Transcontinental Railway Branch Lines Company provides the necessary transportation facilities for the district.

It is interesting to note that Rouyn holds the distinction of being the first mining camp to benefit by a regular airplane service, affording transportation for both passengers and freight, which greatly facilitated the examination of mining properties, and advanced the general development of the region.

Another feature of the development of this camp has been the introduction of electrical prospecting methods. Electrical prospecting it is claimed has given excellent results elsewhere and mining men are watching with interest the progress made by these methods in the Rouyn camp.

The effects of solid mineral discoveries and of the establishment of a mining camp, on the development of a region have been vividly demonstrated in the case of the Rouyn district. In 1923 it was a wilderness, remote from means of communication, bush covered, uninhabited and frequented only by prospectors. Tents, and a few log cabins sparsely scattered over an area of hundreds of square miles, were the only shelters. The first active development work in the region was started on the Horne claim in the fall of 1923, and in 1926, three years later, a 45 mile railway spur was in operation from the Transcontinental to the center of Rouyn township ; a waggon road was opened from Macamic, on the Transcontinental, to Angliers the terminus of the Canadian Pacific Railway, in Temiscamingue, a distance of one hundred miles ; a town has sprung up, which now has more than 500 buildings and a population of 3500 and is increasing daily ; a neighbouring site has been subdivided according to modern principles of town planning ; water works and sewerage systems are being put in ; an electric-power line, sixty miles long, delivers power and light ; a smelter to treat 1000 tons of ore a day is under construction and is expected to be in operation in November 1927 ; a telephone service gives speaking connection with all the centers in Ontario and Quebec.

Gold.

Alluvial gold deposits were exploited very actively some fifty year ago in the county of Beauce, in the basin of the Chaudière river, fifty miles south of the city of Quebec. Between the years 1870 and 1890 some two and a half million dollars of gold was extracted from these sands and gravels. Working was continued spasmodically until 1912, since which year the district has been idle although these gold placers are far from exhausted.

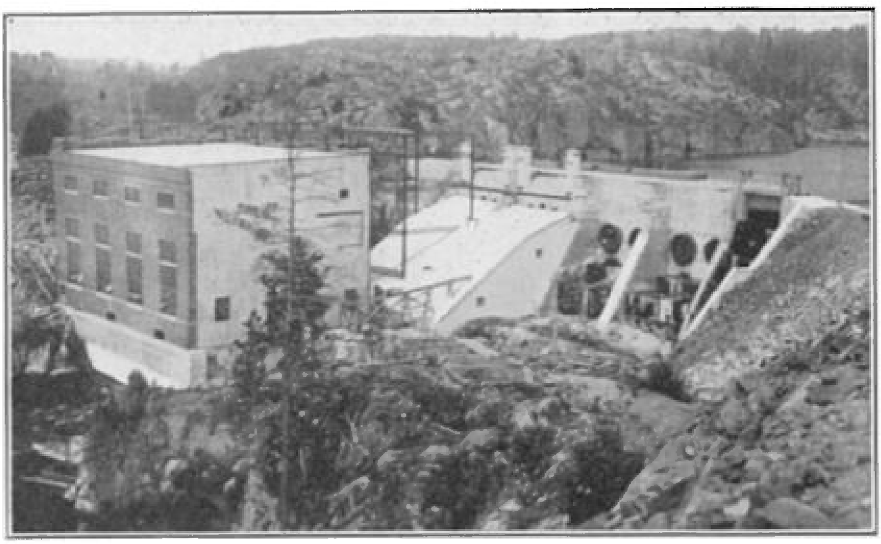
Another source of gold in the province of Quebec is the copper ores of the Eastern Townships, which contain small quantities of gold, recovered in smelting operations.

However the development of the Rouyn copper-gold-zinc and of the quartz gold ores should in a near future place the province of Quebec in the ranks of the important gold producers.

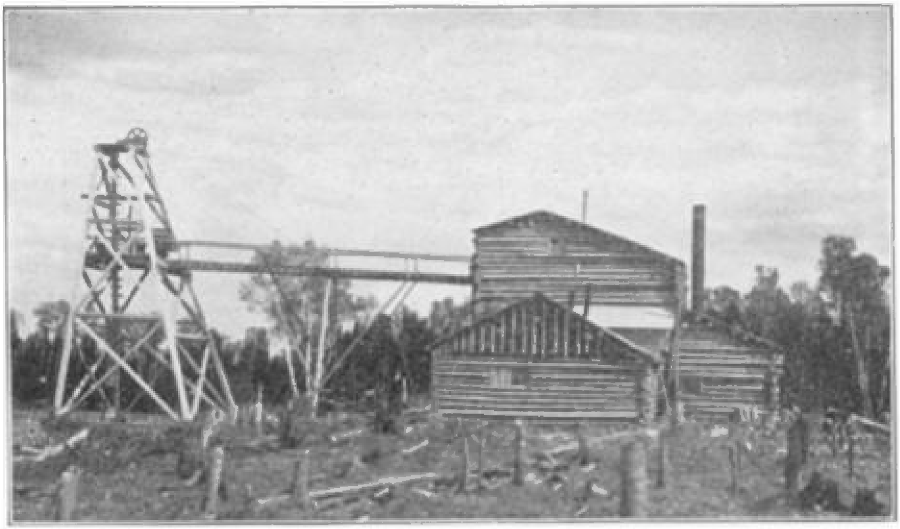
Although Rouyn was originally a " gold camp " attention in that district has, of late, been more especially directed towards the larger sulphide lenticular deposits. These sulphides are gold bearing, some deposits averaging more than $5.00 per ton in gold alone.

The smelting of these ores will yield important quantities of gold, but it is also reasonable to expect that eventually the gold-

First bank building in Rouyn.



Quinze Power Co. Ltd.—Hydro-electric plant at Angliers, which supplies power to the Rouyn mining district.



A gold mine in the making in Dubuisson township.

A copper-gold-zinc prospect, in Duprat township, Rouyn district.

Hydroplane from Haileybury landing on its daily trip to Rouyn.

The town of Rouyn in January 1927.

quartz veins will regain the attention they deserve from the interested public and that their exploitation will contribute to the gold production.

The gold quartz deposits occur in the band of Temiscamingue sedimentaries in the townships of Dubuisson, Bourlamaque, Fournière, Cadillac and Boischatel. They are distinct from the auriferous chalcopyrite deposits previously described under the heading " Copper ". The gold in these deposits is found in the form of native gold ; the presence of arsenopyrite is characteristic of these ores and frequently both the arsenopyrite and the pyrite are remarkably well crystallized.

The general geology of the region has already been described when the Rouyn copper-zinc ores were discussed.

The gold production of Quebec for a number of years, has been as a by-product of the smelting of copper ores and of lead and zinc ores ; for the last three years it has been :

1924	891	ounces valued at	$18,372
1925	1834	" " "	37,909
1926	3679	" " "	76,070

The value of gold is fixed at $20.67 per ounce troy.

Iron.

Mining of iron ores is the oldest of the mineral industries of Quebec. In the early days of settlement in Canada, the iron ore deposits attracted the attention of the explorers. As early as 1667, Colbert, the greatest of Louis XIV's ministers, sent the sieur de la Potardière to study the possibilities of the iron ore of Bay St-Paul, 60 miles below Quebec, and of the bog iron ores of the St-Maurice valley. But it was not until 1736 that the first charcoal furnace was built near Trois-Rivières, and this industry, under the name of St-Maurice Forges, and later Radnor forges, continued almost without interruption to produce charcoal pig-iron of the highest grade, until the year 1910, utilising almost exclusively the local bog iron ores.

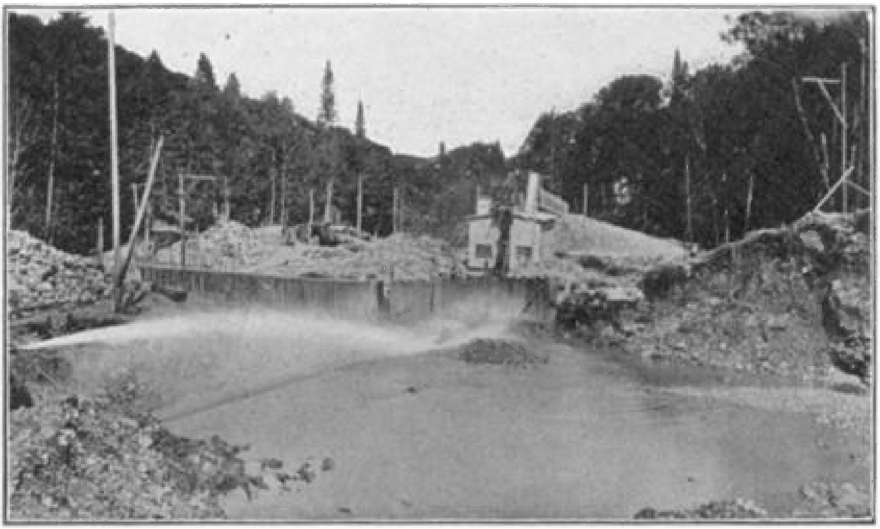
The exhaustion of the ore bodies resulted in the closing down of this industry in 1911.

There are numerous occurrences of iron ore in the Province of Quebec but unfortunately, most of those situated in the settled or accessible parts are titaniferous and are therefore refractory to smelting. Large deposits are known on the Gatineau river ; in the Saguenay district ; on the north shore of the St. Lawrence, but all of these contain titanium, and although such ores make high grade iron, they cannot compete with the Lake Superior or Newfoundland ores for cost of smelting.

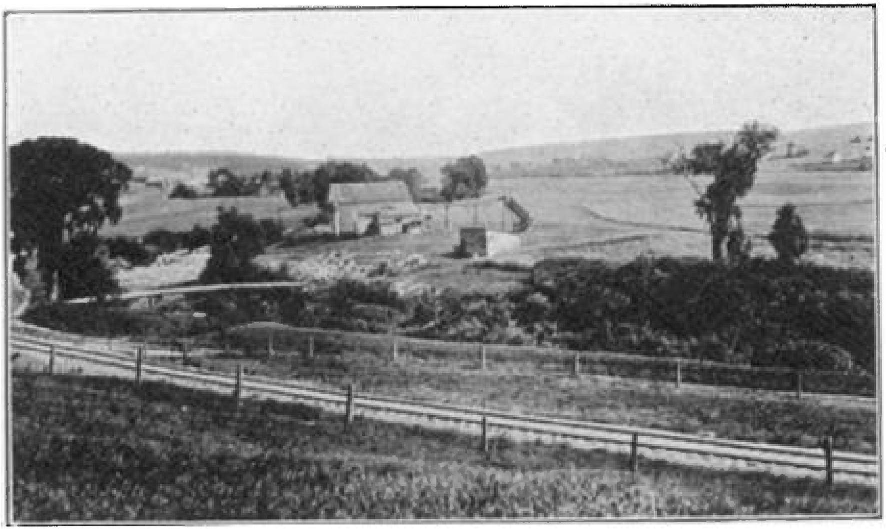
Attention has been drawn however, to certain deposits, favourably located as regards to transportation and power, which offer economic interest because of the possibility of the simultaneous production of iron and valuable by-products, such as titanium and perhaps vanadium.

Apart from the deposits of titaniferous magnetites mentioned, the presence of very large deposits of hematite has been reported by explorers and geologists as occurring in the interior of the province, in the region of the headwaters of the Manicouagan river ; on the Koksoak river ; in the basin of the Hamilton river. But these deposits are hundreds of miles from rail transportation. and are not likely to be used in a near future ; nevertheless they constitute reserves which may eventually be the source of large industries.

Another source of iron, which may be counted upon as a reserve to be used after the exhaustion of the accessible and easily worked deposits such as the Lake Superior mines and the Wabana mines of Newfoundland, are the important iron sands deposits of the North Shore of the lower St. Lawrence. While they are distributed at various places along that shore, as at Betsiamits, Moisie, Mingan, St. John river and others, the most important deposits are at Natashquan, some 600 miles below the city of Quebec. There are present here large quantities of iron bearing sands which contain between 15 and 20% of metallic iron, and, unfortunately, four to five per cent of titanic acid. By concentration the titanic acid can be considerably reduced. These sands are the result of the disintegration of titaniferous iron deposits situated in the basins of the rivers flowing through the Laurentian Plateau and emptying into the St. Lawrence. The



Hydraulic placer mining for gold in the Chaudière river valley.



A typical view in the Chaudière valley.

sands form deposits in bars at the mouths of the rivers and undergo a natural concentration by the wave action of the waters of the gulf of St. Lawrence.

Lead and Zinc.

On an ancient map of Canada dated 1741, a small bay on the east shore of the northern part of Lake Temiscamingue is designated as " Anse-à-la-Mine " (Mine Cove), where a galena deposit outcrops on the very edge of the lake. There are no records of early work on this deposit, but is was very actively exploited between the years 1877 and 1903, substantial shipments of lead concentrate having been made during that period. At the time the mine was closed down the underground workings consisted of a vertical shaft 350 feet in depth and drifts at levels of 50, 100, 250 and 350 feet, with stopes, in places 30 to 40 feet high. The ore was treated in a complete mill, with jigs and concentrating tables, erected near the shaft.

MONTAUBAN DEPOSITS, PORTNEUF COUNTY.

The only zinc property in eastern Canada under actual production is the Tétrault Mine at Notre-Dame-des-Anges, 30 miles north-west of Quebec. Operations at the mine have been carried to the 300-foot level, and 280 tons per day are being extracted. The ore is milled on the property by selective flotation.

Geology.—The deposits occur in remnants or "roof-curtains" of the Grenville series which have been invaded by a granitic batholith. The Grenville series is represented by metamorphic gneisses, quartzite, and crystalline limestones. The limestones, which are usually highly magnesian, are particularly rich in minerals resulting from contact metamorphism : tremolite, diopside, phlogopite and biotite, garnets etc., etc. The carbonate rock also seems to have been an important feature in the localization of the mineral deposits, and here the zinc ore occurs in masses or pockets of very variable size, which, as a rule grade out into the tremolite limestone rock.

The ore consists of sphalerite and galena, accompanied by pyrrhotite, pyrite, chalcopyrite, arsenopyrite, molybdenite and graphite.

CALUMET ISLAND.

An occurrence of lead and zinc has been worked in the southern part of Calumet Island about 58 miles north-west of Ottawa.

The deposit is a replacement in an amphibolite along a shear zone. The mineralized zone extends for about 6000 feet but the ore lenses are irregular and pockety, which renders an estimation of available tonnage impossible until more development work has been undertaken.

The rocks of the region around the deposit are of three types, limestone of the Grenville series, gabbro and diorite of the Buckingham series, now altered to amphibolites and lastly granite.

GASPÉ PENINSULA.

Important deposits of lead and zinc ores were discovered in 1910 and 1911 in the interior of Gaspé peninsula in the region of the headwaters of the Cascapedia river.

The deposits lie in rocks of Devonian age, which have been intruded by dykes and small bodies of porphyries, syenites and granites, all apparently offshoots of the great granite batholith which underlies the interior of Gaspé peninsula.

The ore, honey-yellow sphalerite and galena, is found in fissure veins, sometimes with very clearly defined walls, at other times fading out into mineralized shear zones.The gangue is quartz and carbonate. The deposits are considered to be genetically related to the deep seated intrusions of the region.

Dr Alcock who has charge of geological investigation of this region for the Geological Survey of Canada, in an official report gives the following conclusions :

" The development which has been carried out so far indicates that there is a large quantity of ore in sight. With regard to the persistence of the veins in depth, vein outcrops have been found throughout a vertical depth of 560 feet.... It is probable that such strong veins as the Federal, the Porphyry, the McKinlay, and others extend to much deeper than this. It is commonly assumed that a vein is as deep as it is long ; hence a depth of 1,000 feet or even considerably more is quite to be expected. Should this prove to be the case the Federal would have an available tonnage that would make this one of the large zinc properties in America.''

The great difficulty to overcome in this region has been the lack of transportation facilities. A wagon road from the deposits to Cascapedia, on the Quebec Oriental Railway line, has lately been completed and it is to be expected that the property will soon reach the producing stage.

ROUYN REGION.

Zinc ores are associated with the chalcopyrite deposits of the Rouyn district. Exploration work is being carried on most actively and is giving gratifying results. The geology of these deposits has been described in the chapter on copper.

PRODUCTION.

Production figures of lead and zinc ores for 1924, 1925 and 1926 were :

Year	*Ore, tons*	*Zn, lb*	*Pb. lb*	*Value*
1924	34,000	3,488,560	1,036,648	$ 146,435
1925	70,000	12,857,900	2,583,300	530,112
1926	108,657	16,535,340	4,565,110	1,207,979

This production is all from the Montauban deposits. Should the Gaspé and the Rouyn deposits prove to be as promising as they now appear to be, the next few years should be marked by a great increase in the production of both lead and zinc from the province of Quebec.

Molybdenum.

Molybdenum is a metal, which added to steel in small quantities in the form of ferro-molybdenum, imparts to it special qualities of toughness and hardness. During the war it was in great demand and Quebec deposits supplied very substantial quantities of molybdenite, the principal ore of molybdenum.

In fact one mine alone situated near the Ottawa river, thirty miles above the city of Hull, produced in the year 1918 in the vicinity of 350,000 lb of molybdenite This was the Moss mine, at Quyon, which for two or three years held the world's record for the largest molybdenite production from an individual mine.

There are numerous deposits of molybdenite in the rocks of the Laurentian shield. In Quebec the more important ones are situated in the townships of Huddersfield, Egan, Masham, Onslow, Preissac, Villemontel, La Corne and Varsan.

Deposits of molybdenite are, as a rule, associated with acid types of rocks, granites, pegmatites, etc. At the Moss mine the disseminated molybdenite is found in relation with segregations of pyrite, pyrrhotite, fluorite, quartz and feldspar. In another type of deposit in Masham and Aldfield townships for instance, the molybdenite is associated with sulphides in narrow zones and pockets at the contact of pegmatite dykes.

Molybdenite occurs in quartz fissure veins in the granite of the Kewagama Lake area, Abitibi district.

Deposits of the contact metamorphism type are frequently found in which the molybdenite is distributed throughout a green pyroxene, which intrudes crystalline limestone or gneiss. Such are most of the deposits in the southeastern part of Pontiac county, as well as some in the north Gatineau region.

In spite of the wide-spread and increasing uses of molybdenum steel, the slow consumption of the large stocks accumulated during the last two years of the war, resulted in a period of depression in the mining of the metal. It is only within the last two years that production has been resumed. The United-States, who have molybdenum producing deposits to meet domestic needs, have protected their industry by a tariff regulation.

Concentrates containing 85% molybdenite are quoted at about $0.45-$0.50 a pound.

The production figures for 1924, 1925 and 1926 are :

1924	13,239 lb	molybdenite	valued	at	$ 6,066
1925	30,764 "	"	"	"	11,176
1926	20,943 "	"	"	"	10,472

Platinum.

As far back as 1851, Dr. Sterry Hunt, chemist to the Geological Survey of Canada observed the presence of grains of native platinum, and of scales of iridosmine, among the native gold washings of the Rivière du Loup and of Rivière des Plantes in the county of Beauce. But no mention of further observations or discoveries seems to have been made in subsequent reports.

Silver.

There are no silver mines known in the Province of Quebec. There is however a steady production of the metal, recovered in the treatment of sulphide ores, such as lead and zinc ores, copper ores, the output depending upon the activity in the mining of these ores.

The figures for 1924, 1925 and 1926 are :

1924 . . .	73,251	ounces	valued	at	$ 48,833
1925 . . .	240,297	"	"	"	165,974
1926 . . .	375,986	"	"	"	233,513

Silver is worth about $0.60 per ounce troy.

Tin.

Although no workable deposits of tin ore have yet been discovered in Quebec, it is interesting to note that the presence of microscopic crystals and grains of cassiterite, the natural oxide of tin, has been observed in the gneisses of the graphite area of the Buckingham district.

Tungsten.

In the report on Mining Operations in the Province of Quebec for 1918, the following mention is made of the occurrence of an ore of tungsten.

" In the spring of 1918, owing to the high prices of tungsten ores some prospecting was carried on in Marlow township, whence the presence of specimens of scheelite had been reported in 1891. This resulted in the discovery of a persistent quartz vein carrying scheelite, on lot 1, range VI of Marlow.

" The quartz vein is very persistent and varies in width between 9 and 15 inches. It has been uncovered by strippings and can be traced continuously for 700 feet and could probably be traced further. The quartz is mineralized by specks of galena, pyrite and crystals of scheelite (tungstate of lime) but the content of the whole vein in scheelite would not be high, probably less than one per cent, which would render it unremunerative."

Rare Earths.

Radioactive minerals.

No workable deposits of radium ores have yet been discovered in Canada, but individual specimens of radioactive minerals, uraninite or pitchblende, samarskite, cleveite, and gummite have been found in the province of Quebec in the following places : (1) Maisonneuve township, Berthier county, lots 1 and 2, range II ; (2) at Lake Pied-des-Monts, Charlevoix county, 18 miles north of Murray Bay ; (3) Villeneuve township, Ottawa county, lot 30, range I ; (4) Wakefield township, Ottawa county, lot 25, range VII.

Cerium ores.

The presence of a comparatively important deposit of allanite (a complex silicate of cerium), has been observed on the east shore of Lac-à-Baude, in Normand township, north of the Seigniory of Cap de la Madeleine. Unfortunately the deposit is too far from means of transportation to be worked economically under present conditions.

NON-METALLICS.

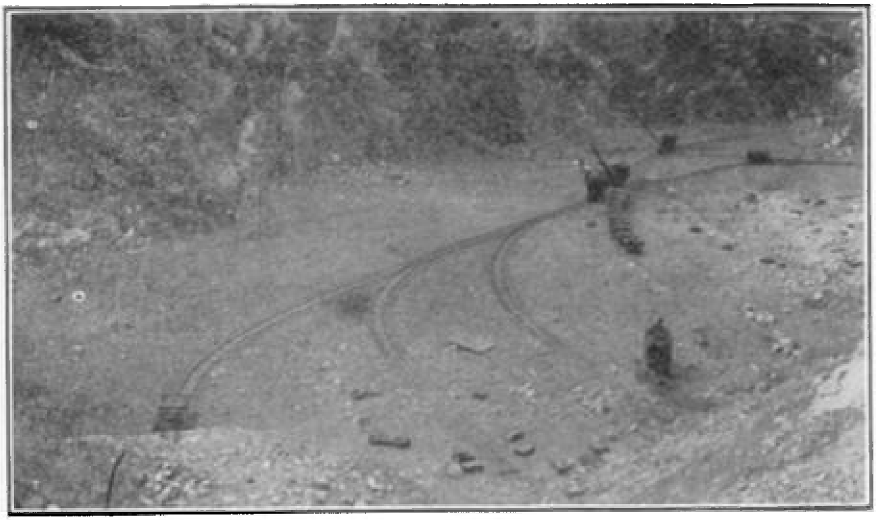
Asbestos.

The term " asbestos " is applied to a class of minerals, the characteristic features of which are a fibrous, or thread-like structure and incombustibility, which permit them to be spun and woven for the manufacture of fire-proof tissues.

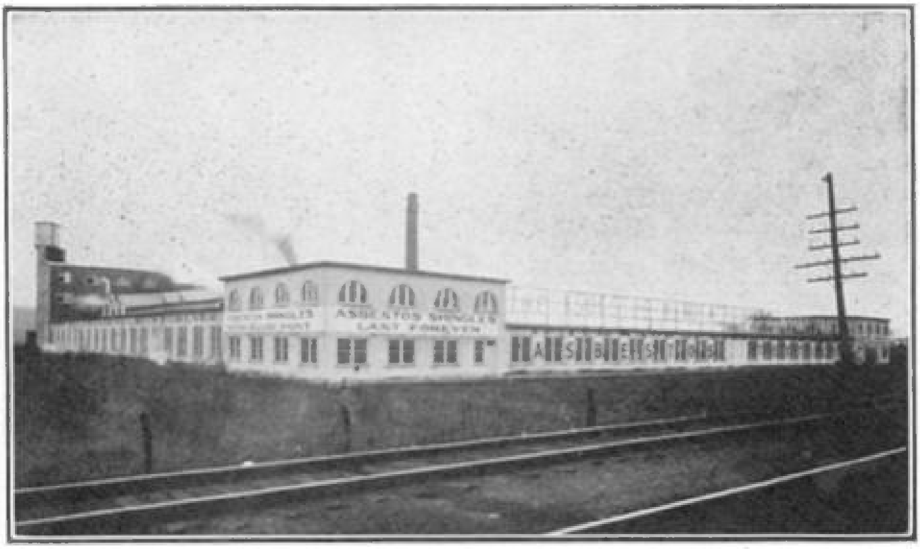
Of all the minerals which yield fibrous varieties, the one which is most prized is the chrysotile-asbestos, owing to the whiteness, silkiness and strength of the fibres. Chrysotile is a hydrosilicate of magnesia, of lustrous greenish colour when in the rock, but perfectly white when it is fibrerized for spinning. It stands temperature of nearly 1000 degrees Fahr. without altering, resists corrosive liquids, and is an excellent non-conductor of heat and electricity. Chrysotile represents some 98% of the asbestos used industrially and the province of Quebec supplies over 80 per cent of the world's consumption of this mineral.

Phot. Asbestos & Min. Corp. N. Y.

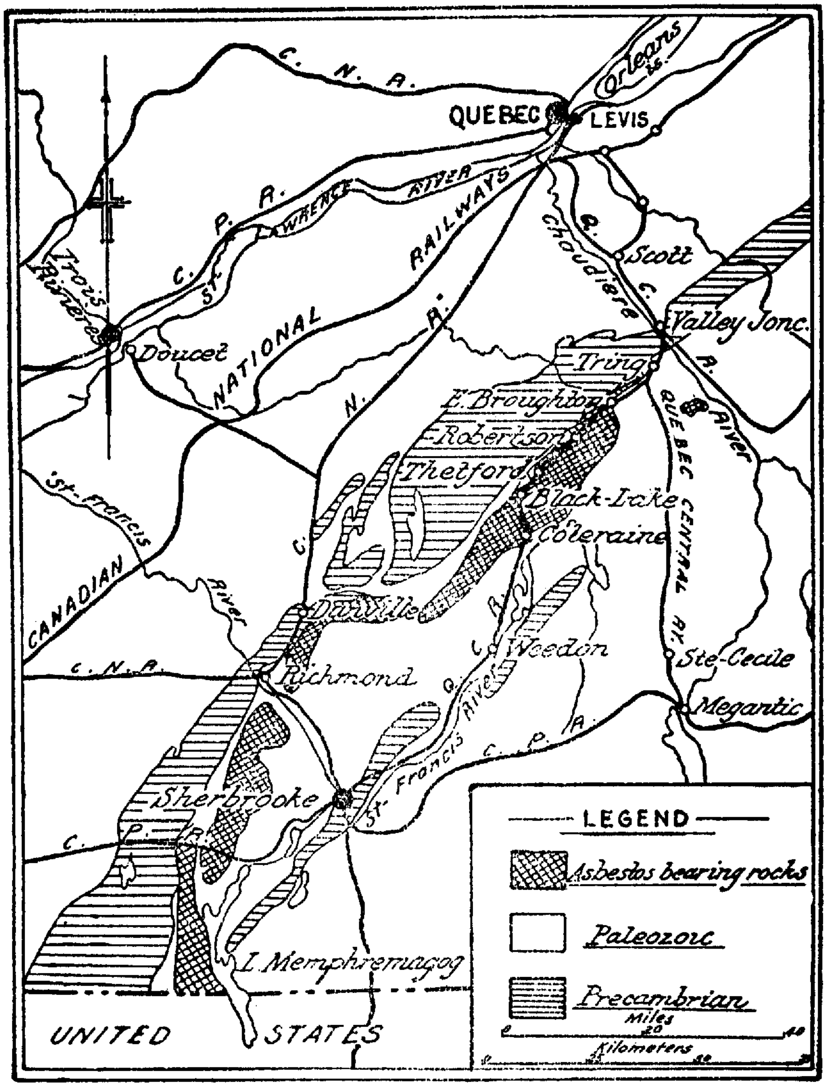
A modern open-cast pit, worked in benches and by cable-derrick hoisting. Some of these excavations reach 350 feet in depth and a width of 900 feet.



Bottom of an asbestos open pit, at Thetford Mines.



Plant for the manufacture of asbestos products.



Sketch map of the "Serpentine Belt", in which occur the deposits of asbestos.

Distribution of the deposits.

The asbestos deposits of Quebec occur in a long development, or series, of basic intrusive rocks, which is usually referred to as " the Serpentine Belt ". This belt starts in the United States, and enters Canada at the boundary line between the State of Vermont and the province of Quebec, just west of Lake Memphremagog. From the international boundary line to within a short distance of the Chaudière river a tributary of the St. Lawrence, this development of rocks is almost continuous presenting a long narrow zone of over one hundred miles. The general trend of this serpentine belt can be traced in the same north-easterly direction by disconnected outcrops, for a further distance of seventy miles, as far as l'Islet county. Then occurs a gap of 130 miles, and more developments of serpentine rocks are found in the Gaspé peninsula, large occurrences being found in the Shickshock mountains, at Mount Albert; on the York river; and in the township of Weir.

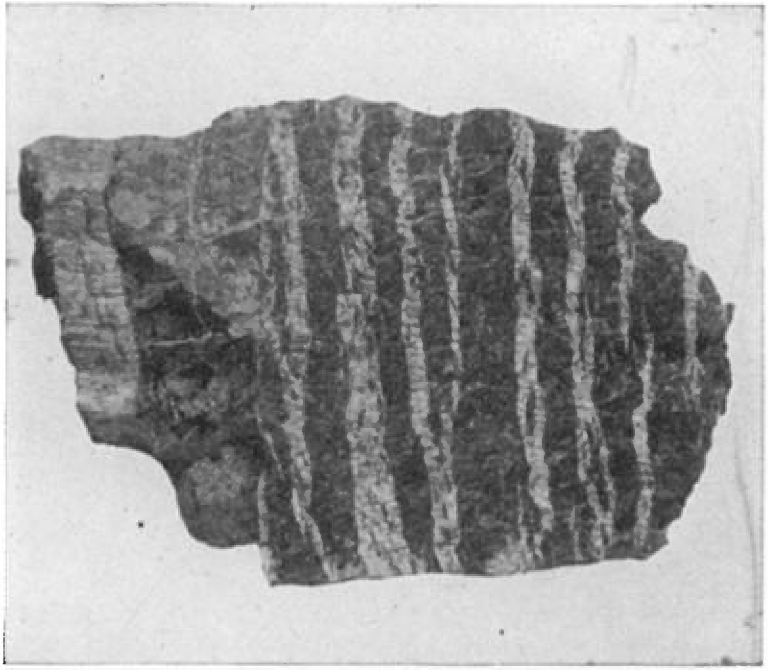
Geology of the Asbestos deposits.

This belt is constituted by igneous and metamorphic rocks, which comprise peridotites (olivine rock), pyroxenites, diabases, granites, serpentines and talcose schists. It is true that the serpentines occupy a total area much smaller than the other members of the zone, but as they are the important economic rocks, and moreover, are more easily recognisable on account of their characteristics, it is from their presence that is derived the designation " Serpentine Belt ".

Asbestos occurs in two forms in the serpentine :—(1) as veins having well defined walls, along which they part easily from the enclosing serpentine rock ; (2) as disseminated fibre in the rock, without any definite arrangement.

Vein asbestos is sometimes called cross-fibre asbestos, from the disposition of the threads, which lie transversely, or at right angles to the walls of the vein. Therefore in this case the width of the vein determines the length of the fibre.

Disseminated fibre is found unevenly distributed throughout the serpentine, and does not occur in well defined veins. It often



Asbestos rock, showing the banded or ribbon structure of the asbestos veins.

Asbestos veins in working face of quarry.

constitutes a large proportion of the rock, but as a rule it is shorter than the cross-fibre, and its average value is lower than the vein material. From the disseminated fibre rock, ten to twelve per cent of asbestos can sometimes be extracted, whereas vein-asbestos rock does not yield more than four to six per cent of fibre.

The serpentine which contains the asbestos deposits owes its origin to the alteration of rocks rich in the mineral olivine, such as peridotites and dunites. The chemical composition of chrysotile asbestos and serpentine, is identically the same. The difference between them lies essentially in the physical disposition of the molecules, which makes asbestos a fibrous mineral, while serpentine is massive. It is therefore impossible to ascertain by a chemical analysis what percentage of asbestos certain samples of serpentine contain. Physical tests (crushing, rolling, screening) can alone give such data, and the figures obtained only represent proportions of recovery or extraction, and not absolute contents.

Producing areas

The asbestos-bearing rocks of the Serpentine belt may be roughly divided into five separate fields or areas, each one of which possesses distinctive features. They may be designated as follows, the enumeration being given in geographical succession from north-east to south-west : (1) Gaspé peninsula occurrences, which are not worked ; (2) the Broughton township area which is worked, and which yields mostly short fibre ; (3) the Thetford-Black Lake field, which is the most important producer in the world ; (4) the Danville district, which produces short fibre, but also a small proportion of long material ; (5) the Bolton area, west of Lake Memphremagog, which has never passed out of the prospecting stage.

A gap of 250 miles occurs between the Gaspé occurrences and the East Broughton field, but the delineation of the belt can be followed by occasional outcrops of serpentine, some of which contain short asbestos fibre.

The presence of asbestos in the province was first officially mentioned by Sir William Logan, in the Geological Survey report of 1847-48 ; but attention to the Canadian asbestos was first attracted by a specimen of the silky-fibred chrysotile exhibited at the London exhibition in 1862. This specimen came from a small occurrence of serpentine near the Chaudière river. Nothing was ever done towards working the deposit.

In 1877 asbestos was discovered in the serpentine belt of the townships of Coleraine and Thetford, and in 1878-79 three mines were opened up at Thetford, by Mr. Andrew Johnson on lot 27, range VI ; Mr. Ward on lot 27, range V ; and Messrs. King Bros. on lot 26, range V, respectively. It is remarkable that these three mines, the first ones opened in the region are now considered the best and richest, forty-six years after their discovery ; one of these, the Johnson mine was under the same general manager, Mr. Andrew Johnson, until his death in June 1926.

Mining and Milling of Asbestos rock.

Until recently all the asbestos deposits were worked by quarrying methods in open pits. Some fifteen years ago a progressive policy of tunnelling was initiated, with a view of blocking out reserves of milling rock. Later on diamond drilling on a large scale was adopted for exploratory work, and gradually other methods of mining were evolved, and there are now four main types of exploitation, as follows :—(1) Open-cast quarrying and cable-derrick hoisting. This is a development of early methods, but is now done on a large scale. One of the mines using the method has a hoisting capacity of 3500 tons of rock per shift of ten hours. (2) Open-cast quarrying, and hoisting in trains up an inclined tunnel for conveyance to the mill. In this case, the mine cars are loaded by steam shovels running on tracks or on caterpillars. (3) The third method of mining is the " Glory Hole " or " Milling " system as adopted for the exploitation of many large ore bodies of low grade. This method is a combination of open-cast and underground work. (4) The fourth method is by series of quarrying faces on wide benches along which circulate trains of cars, standard gauge, hauled by locomotives, following the principle adopted in the large iron mines of the Lake Superior district. The cars are loaded by steam shovels, and hauled in trains to the mill bins, by 38 tons steam locomotives.

Phot. Asbestos & Min. Corp., N. Y.

A modern mill for the separation of asbestos fibre from the rock.

The asbestos mines and mills of the three producing fields of Thetford, Danville and East Broughton require for their operation some 18,000 H.P. which is practically all supplied from Shawinigan Falls, where electric power is developped on an immense scale. The electric power used by the asbestos industry is therefore transmitted by a line of one hundred and ten miles long, under a tension of 50,000 volts. As Shawinigan Falls is situated on the north side of the St. Lawrence river, this line is carried over the river by means of two steel towers, 350 feet high, erected on opposite banks five thousand feet apart.

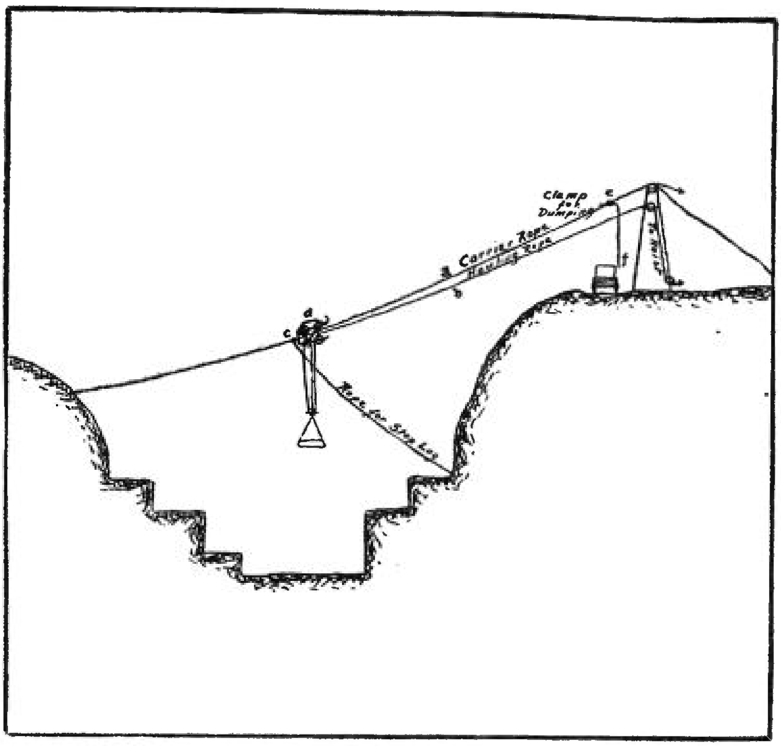
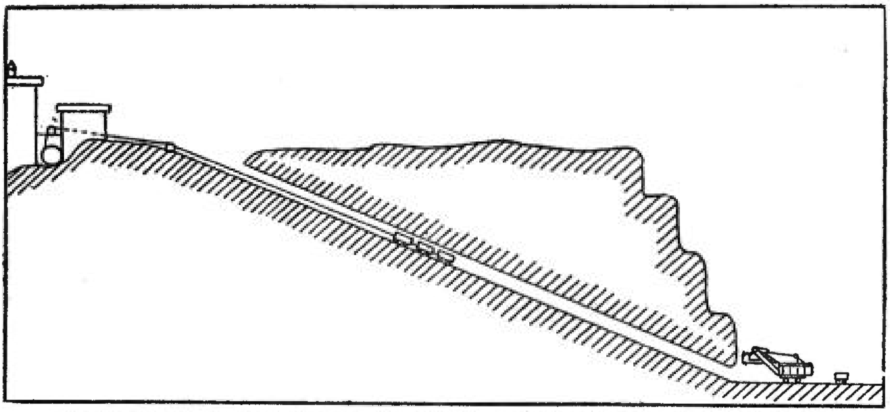


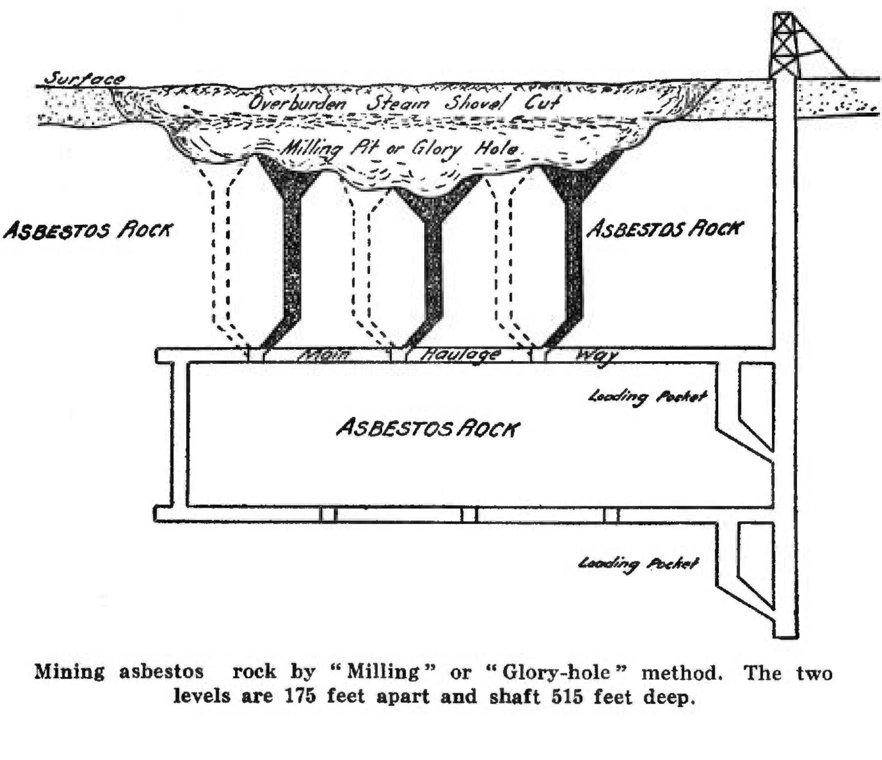
Diagram of quarrying asbestos rock by open its, and hoisting by cable derrick.

The long fibre asbestos, called " Crude asbestos ", is separated from the rock, on the floor of the pit, by breaking up the larger pieces of rock with small charges of dynamite, sledge hammering, and cobbing by hand. The long fibre qualities comprise the



Loading asbestos rock by steam shovel, and hoisting by inclined tunnel.

asbestos of half an inch and more. The "crude" asbestos, which is the highest priced material constitutes only a small part of the output, from one to five per cent, of the production of the



Mining asbestos rock by "Milling" or "Glory-hole" method. The two levels are 175 feet apart and shaft 515 feet deep.

mine, or a small fraction of one per cent of the weight of the rock mined. The great bulk of the asbestos is therefore separated from the rock by mechanical means.

The operation of milling the rock to extract the fibre from it, is comparatively simple in principle, but complex in its details. Briefly stated it consists in (1) breaking the rock in jaw crushers; (2) drying it ; (3) secondary crushing in gyratories ; (4) pulverizing it to liberate the fibre ; (5) passing the pulverized rock and fluffed up asbestos over shaking screens, and separating the asbestos by a suction apparatus designed on the principle of the well known household vacuum cleaner ; (6) passing the fibre through " graders ", which classify it into grades according to the length of the fibre.

The product from the mill is of several grades. These grades are determined by a standardized system of screen analysis.

The price paid for asbestos is dependent in a very large measure upon the length of the fibre. The tremendous importance of this factor will be readily seen from the fact that the value of a ton of asbestos may vary between $350 and $15, according to the length of the fibre alone. The first figure represents the value of No. 1 crude, about 1" and over in length, while the latter is approximately the price of paper and mill board stock, which is less then ¼" in length.

Uses of Asbestos.

Asbestos is textile, incombustible and a good insulator of both heat and electricity. These qualities are not found combined in any other substance. It can stand high temperatures, up to 800° or 1000° F., without bad effects. Its applications, therefore, are very wide, and it will be sufficient to enumerate a few of them, as the uses are extending daily. Some of these uses appeal to the popular imagination, such as incombustible theatre curtains; protective gloves, leggings and aprons for metallurgical works ; firemen's garments, and many others ; but it is in the less spectacular services that the great proportion of asbestos is used ; steam packing ; packing sheets ; gaskets and washers ; ropes and yarns ; heat insulating coverings and jackets for steam boilers and steam pipes ; fire proof felts and papers ; fire-proof building materials, as asbestos shingles, asbestos boards, asbestos lumber ; lagging for railway locomotive boilers and marine engines ; insulating coverings for electric wires ; brake-band lining for automobiles.

Production figures for the last three years were :

1924	208,762 tons	valued	at $	6,561,594
1925	273,522 "	"	"	8,976,645
1926	279,389 "	"	"	10,095,487

Extensive diamond drilling and underground exploration on a large scale have shown the existence of immense reserves of asbestos ores, so that the industry has good prospects of a long and prosperous life.

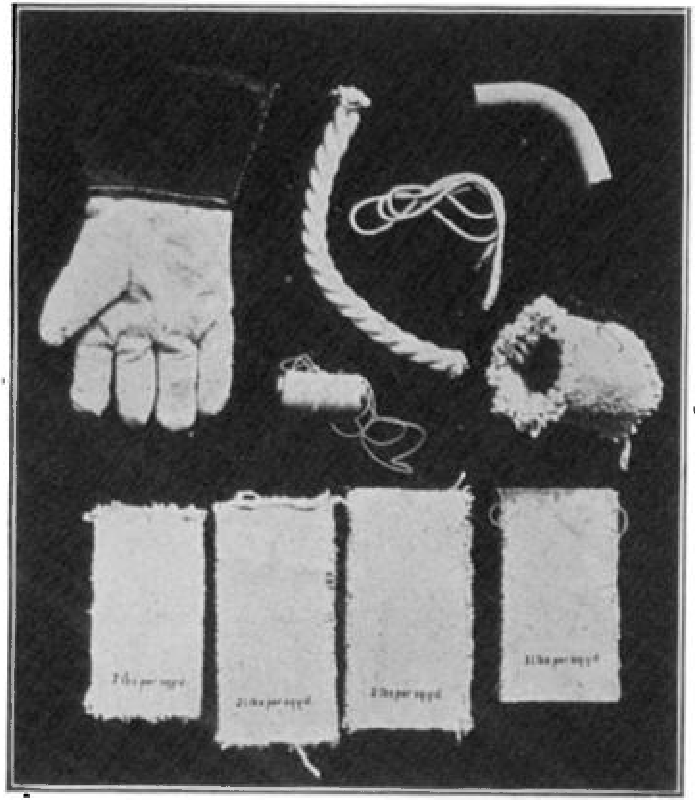
Feldspar.

It has been mentioned in the geological sketch given in the first part of this pamphlet, that almost the whole of the area of the province of Quebec situated to the north of the Ottawa and St. Lawrence rivers is underlain by rocks of a granitic nature. In many places these rocks outcrop as dykes of pegmatite offering resources of feldspar which probably cannot be duplicated anywhere in the world. However some of these dykes contain quartz, mica or other deleterious minerals ; many are too remote from transportation to permit economic working. In fact only those deposits most favourably situated near a railroad or within a short distance of water transportation can be exploited, for feldspar, even of high grade, is a low-priced product, of the order of $5 to $10 per ton.

The valley of the Lièvre river, tributary of the Ottawa river is the main feldspar producing district of the province of Quebec and the town of Buckingham is the principal shipping centre. The feldspar of this district is high in potash, carload lots running as high as 13½% potash, 1 to 1½% soda, 4 to 5% free silica.

Very large deposits of feldspar, of good grade, occur in various places on the north shore of the gulf of the St-Lawrence, an important deposit has been worked at Quatachou-Manicouagan

Man dressed in asbestos suit, to approach gas-well on fire.



Some articles made of asbestos.

Bay, some 500 miles below the city of Quebec. The production of feldspar in the Province of Quebec is limited only by the demand.

Feldspar is used mainly in the ceramic industries. It enters into the body of various potteries and chinaware, mixed with china clay, ball clay and flint.

It also is used in the manufacture of enamel glazes for tiles, brick, white chinaware and other clay wares.

Feldspar is a large constituent of the enamel for metals such as household enamel ware, and granite ware, sanitary ware such as bath tubs, basins, sinks, wash tubs.

Artificial teeth are manufactured from very pure orthoclase feldspar, known as " dental spar ".

Feldspar enters into the composition of scouring soaps and scouring powders, because its hardness, which is much less than that of quartz sand, permits of its use as a scouring agent which will not scratch the surface being cleaned.

The production of Quebec feldspar for the past three years has been :

1924	16,222 tons valued at	$143,076
1925	11,287 " " "	94,730
1926	13,168 " " "	111,136

Garnet.

There are a large number of deposits of garnet in the Province of Quebec, some of which might be suited for the production of abrasive material. There is a demand for garnet of good quality for the manufacture of abrasive papers, used chiefly in the wood working industries.

Sharp cutting edges are demanded of the crushed garnet grains, and this is dependent upon the toughness ; crumbly garnet is practically useless for abrasive purposes.

It is reported that preparations are being made to exploit a deposit of excellent abrasive garnet two miles southwest of Labelle, one hundred miles north of Montreal.

Garnet concentrates are valued at about $85 per ton.

Graphite.

Graphite mining began in the province of Quebec as early as the year 1847 when several tons of graphite was extracted from a vein in the crystalline limestone near Grenville, on the north shore of the Ottawa river, half way between Montreal and Ottawa.

Deposits of graphite are numerous in the province, especially in the basin of the Lièvre river, where the mineral is found as disseminated flakes in zones through crystalline limestones, banded gneisses and quartzites of the Grenville series. Some of these zones, more especially in the crystalline limestones, run high in graphite, up to 30% and more of carbon.

Graphite deposits on which considerable work has been done occur in the townships of Grenville, Buckingham, Lochaber, Amherst and Campbell. In all these places the graphite flakes are found disseminated in crystalline limestones and sillimanite gneisses of the Grenville series, probably remnants of highly metamorphosed sediments of Precambrian age. The ore treated contains 8 to 15% of graphite, but is very refractory to concentration treatment, which results either in a product of inferior grade, or in a very low recovery and high costs when the graphite is high grade. There is little doubt that large quantities of ore containing 10 to 15% graphite could be counted upon, and in spite of numerous failures to exploit the mineral profitably attempts to establish a permanent industry have been almost continuous for nearly forty years which have resulted in small annual productions.

In determining the value of a graphite ore, granted that there is a sufficient tonnage available, the governing factor is the size of the flake. Since there is a regular market only for large flake, the value of the ore depends on the amount of No 1 and No 2 flake recoverable rather than on the total graphite content of the ore (No 1 flake is that remaining on a 90 mesh screen). Thus it is possible that a 10% ore may be more valuable than a 15% ore if more No 1 or No 2 flake can be recovered from it.

The Quebec graphite industry suffered a period of depression due to the accumulation of large stocks in Ceylon and Madagascar in the three years following the war.

However when these stocks were exhausted in 1924 the prices in New York for flake graphite, of which the whole Quebec production consists, rose from about $0.04 to $0.09 a pound.

Should these latter prices persist, the introduction of oil flotation concentration processes which are giving satisfactory results, should enable the Quebec graphite to compete once more on the United States market in spite of a tariff of 1½ cents per pound which is now in force.

The production of graphite for the last three years has been very small :

1924	45 tons valued at	$ 3,264
1925	354 tons valued at	40,792
1926	326 tons valued at	29,516

Infusorial Earth.

Several deposits of Infusorial Earth or Tripolite are known to occur in the province of Quebec, but they have not been investigated as to their importance. Some of the occurrences which appear to be among the important ones are given below.

Montmorency county.—Laval Settlement, Range II, lot 10. This deposit is on the right bank of the Bras, at its junction with the Montmorency river. The bed is reported to be 15 feet thick, at a height of 40 feet above the water, and is covered by fifty feet of overburden.

Portneuf county.—Gosford Tp., range IX, on the east side of the North branch of Ste Anne River.

Colbert Tp., lot 41B.—Presence reported of a bed of white infusorial earth.

Montcalm county.—Chertsey Tp., range V, lot 15.

Other deposits have been mentioned as occurring in the counties of Maskinongé, St. Maurice, Quebec, but without precise location.

Infusorial earth owes its origin to the accumulation of the siliceous skeletons of minute organisms known as diatoms. It is also called diatomaceous earth and owes its value to two characteristics (1) extreme porosity, with consequent low apparent density (2) relative chemical inertness. It has been put to a great number of uses but the most important of these are as a filtering substance and as a heat insulating material. This latter use especially offers very great possibilities as the available markets are as yet barely touched. The prices of diatomaceous earth vary between $10 and $45 a ton, depending upon the quality, which in turn is chiefly governed by the physical, rather than by the chemical properties of the material.

Kaolin.

In the report of the Minister of Lands and Forests for the year 1894-95 Mr. Obalski, the mining engineer of the Quebec Government, mentions that while digging a well for water on lot 5, range VI South, Amherst township, at a depth of 15 feet, a bed of kaolin, or china clay, 2½ to 3 feet thick, was encountered, but that the material contained a large proportion of quartz grains. As the locality was 45 miles from a railroad at the time of the discovery, the find was regarded as interesting but of little economic value.

Later on, after the advent of the railway lines into the region, interest in the old kaolin discovery was awakened, and in 1912 the Canadian China Clay Company was organized to work it.

According to Dr. M. E. Wilson of the Canadian Geological Survey who made a study of these China clay deposits "the most extensive deposits of kaolin so far discovered in this zone, are on lots 5 and 6, where an almost continuous lead of kaolin, ranging from a few feet to 100 feet in width, has been laid bare by stripping and test-pits for a distance of 1,400 feet. Bore-holes on this deposit show that it persists to a considerable depth beneath the surface, a depth of 150 feet in kaolin having been attained at one point. Although the kaolin leads everywhere contain considerable quartzite, either in the form of fragments or finely disseminated grains, the determination of the amount of kaolin contained in average samples shows that the kaolin content in the masses of kaolin as a whole is not less than 35 per cent."

A washing plant for the removal of the quartzite was erected, and the product, a high grade China clay, was marketed mainly as a filler, used in the manufacture of paper.

Other deposits were found on lots 11 and 12 of the same range, which seems to indicate that China clay occurs, apparently without discontinuity, from lot 2 to lot 12, a distance of 10,000 feet.

The presence of kaolin has also been observed in Potton township.

China clay or Kaolin is unfortunately not a high priced product, the average price being below $10 per ton. The large proportion of quartz, necessitating expensive washing treatment, and other unfavourable market conditions have led to the suspension of operations. The last recorded production was in 1923.

Lithium.

The existence of a deposit of lepidolite, a lithium bearing mica, has been recorded in Wakefield township, Hull district. The lepidolite is here found in large flakes and sheets irregularly distributed through a pegmatite dyke. Sufficient development work has not yet been carried out to ascertain the commercial possibilities of the deposit.

The main use of lithium minerals is in the glass industry. Market quotations for lepidolite are about $20 to $30 a ton.

Magnesite.

Magnesite is a refractory mineral widely used to line open-hearth and electric furnaces for the manufacture of steel. It is used both in the form of refractory bricks for the sides and dome, and in granules which are tamped in layers to form the bottom. In the raw state magnesite is a carbonate of magnesium, but for use as a refractory material it is calcined into magnesium oxide, or sintered at a higher temperature into "dead-burned" magnesite.

The province of Quebec possesses the only known Canadian deposits of workable size. They are situated in the townships of Grenville and Harrington, in Argenteuil county, on the north side of the Ottawa river, half way between the cities of Montreal and Ottawa. The knowledge of their existence dates back to the year 1900, but it was only in 1907 that work on them was begun, in a small way, to supply material for the manufacture of flooring cements, and for the production of carbonic acid gas for aerated waters. But the war cutting off the Austrian source of magnesite, whence came by far the greater part of the world's supply for the steel industry, the attention of users of refractory materials was drawn to the Quebec deposits and for several years large annual productions of Grenville magnesite were recorded.

At first a strong prejudice existed against the Quebec magnesite, owing to rather high contents in lime, and the lack of iron oxide which impaired its bonding qualities for furnace lining material. However, after experimentation to remedy these defects, a dead-burned magnesite is now manufactured from the Grenville material, which gives full satisfaction, and has been declared by metallurgists who have used it to be equal to the Austrian product. By strict chemical control, the lime is converted into silicates of lime and iron, which are neutral compounds, increasing the power of resistance to corrosive agents, and an addition of finely powdered magnetite, intimately mixed before sintering supplies the binding qualities.

The use of magnesite as one of the raw materials for the manufacture of magnesian flooring cements and stuccos offers a market for increasingly great quantities. As yet the Quebec magnesites have not been used to any extent for this purpose.

The chief markets for Canadian magnesite are in Canada and in the British Isles. The United States markets are practically closed by tariff regulation.

The production for the last three years has been :

1924	7950	tons	valued	at	$101,122
1925	9967	"	"	"	122,325
1926	9130	"	"	"	137,431

The tonnage is expressed as crude magnesite rock, but it was marketed in the form of calcined and dead-burned magnesite.

The price of dead-burned and calcined magnesite varies between $30 to $40 a ton.

Removing overburden from a deposit of china-clay in Amherst township.

Magnesite sintering plant at Calumet, for manufacture of "dead-burned".

The deposits of magnesite of Argenteuil are very large, and could supply much greater quantities annually, should the market require it.

Manganese.

Deposits of pyrolusite and bog manganese have been observed on the Magdalen Islands.

" The most important point where manganese ore has been found is in the middle of Grindstone Island on Quinn's lot. Several years ago a slight excavation was made whence several tons of pyrolusite of good quality were extracted and shipped. (Mining Operations 1903).

" Immediately under Demoiselle Hill, on Amherst Island (in the Magdalen islands group), numerous blocks charged with peroxide of manganese, or pyrolusite, occur among the débris of the fallen cliffs. They are in pieces varying from one pound to ten or fifteen pounds in weight. There can be little doubt that they are derived from a deposit more or less regular in the hillside, but which is now completely concealed by the fallen debris. At a place, bearing nearly due west from Cap aux Meules, at the distance of about a mile, and close to the English Mission Church, similar pieces to those above described are very frequently picked up. Numerous stones of this character were observed by me at this locality, but as the ground was covered with growing crops I did not attempt any further search." (Geol. Surv. of Can. Rep. G., 1879-80.)

Manganese ores are used in the manufacture of alloys, for which ore of 40% and less is suitable ; also used in the manufacture of chemicals for which the minimum grade is 50% Mn. The metallurgical ores market at about 50c. a unit or $20 a ton ; the chemical ores at $1 to $1.50 a unit, $50 to $75 a ton.

Mica.

In the province of Quebec both white mica (muscovite) and amber mica (phlogopite) are present in workable deposits. Until 1890 or so the main use of mica was as a refractory light-transmitting substance, for furnaces, stoves, lanterns and small windows. For this purpose the white mica or muscovite was the more prized of the two, and this variety was the only one worked in the province. Amber mica was well known to occur, and very appreciable quantities had been extracted in the course of phosphate mining, but all such mica had been thrown away on the dumps as valueless.

In 1890 or 1891 the great expansion in the manufacture of electrical machinery and apparatus drew attention to the high dielectric qualities of amber mica, its elasticity, resistance and cleavability into very thin sheets, and it was soon widely employed in the construction of dynamos, electric light sockets and plugs. At present no muscovite is being worked in Quebec, but a large number of phlogopite, or amber mica, mines are operated.

The mica producing district, par excellence, of Quebec is that comprised by the adjoining basins of the Lièvre and Gatineau rivers. It embraces an area of 40 miles north and south, by 25 miles east and west.

For the construction of electric machinery the Quebec mica is second to none, its essential qualities of insulation, flexibility, elasticity, toughness and cleavability being of the highest.

The mica deposits are unfortunately pockety and unpersistent; the mica forms segregations of crystals of all sizes in zones and pockets, in lenses of pyroxenites, which rock probably owes its origin to the alteration of magnesian limestones.

The exploitation of such deposits is obviously attended by much uncertainty, and the impossibility of blocking out reserves precludes the erection of expensive plants to permit working on a large scale.

Moreover the price of mica varies with the grade, from $8.00 a ton for scrap mica to $5 a pound for extra large thumb-trimmed mica sheets, and this contributes to rendering mica mining hazardous.

At present most of the mica deposits are worked by open pits, and the workings are of a superficial nature, which is practically quarrying. But in a few cases the mica deposits have been followed in depth, by shafts and underground workings, and in all cases valuable mica has been found. One of these underground mica mines is entered by an inclined shaft of 60°, to a depth of nearly 300 feet, and drifting has been performed on a distance of 300 feet, with excellent results. It may therefore be said that our mica deposits have only been scratched on the surface. The value of the production of mica from the Quebec mines varies between \$100,000 and \$300,000 annually. The production of mica from the province for the last three years has been :

1924	3,252,583	lb	valued	at	\$162,951
1925	6,156,029	"	"	"	200,512
1926	3,337,644	"	"	"	170,118

There is a tariff on imports of mica into the United States of between 20% and 40% depending upon the grade.

Mineral Pigments.

Natural iron oxide and ochres.

The province of Quebec possesses numerous deposits of natural iron oxides and ochres, the majority of which contain material of very high grade, assaying after drying and calcination, 90 per cent. or more iron oxide, while some reach 98 per cent. Several of them have been worked for many years. For the manufacture of paints, however, the nature of the impurities present, and the colour, may be of greater importance than the actual iron oxide content.

The material of such deposits is a hydrated oxide of iron more or less mixed with fine clay. The hydrated oxide of iron comes from the decomposition of the iron minerals, magnetite, hematite, siderite, iron pyrites, which are widely disseminated throughout the granites, gneisses, anorthosites and other rocks of the Laurentian Plateau. These hydrated iron oxides are washed into the streams and carried by them to the low places where they settle to form iron oxide and ochre deposits. Therefore most of such deposits are found in the vicinity of the foot of the southern escarpment of the Laurentian Plateau, which runs parallel to the north shore of the St. Lawrence river, from Montreal to the Strait of Belleisle.

Some of these deposits are worked on a comparatively large scale, in the vicinity of the city of Trois-Rivières, on the north side of the St. Lawrence, half way between Montreal and Quebec ; at Ste-Anne de Beaupré, near Quebec ; at the mouth of Petite Romaine river, 130 miles below Quebec ; in Lynch township, Labelle county, and other places.—Some of these deposits attain thicknesses of 20 feet and over. The iron oxides and ochres produced in Quebec may be subdivided into two classes, the raw oxides which are marketed without any preparation, and are used in the manufacture of coal gas, as a purifying agent to absorb the hydrogen sulphide from the gas ; and the calcined oxides which are further treated for the manufacture of paints.

The natural, raw oxides sell for a very low price, three to four dollars per ton. On the other hand the calcined ground oxide for the paint industry is worth about ten times as much, that is around $40 per ton.

The Quebec production of ochre, partly raw oxides and partly calcined, for the last three years was :

1924	7,129 tons	valued at	$ 88,540
1925	6,984 "	" "	89,173
1926	6,517 "	" "	100,923

Barytes.

Barium sulphate or heavy spar is the main constituent of the white pigment " lithopone ", which is composed of 50% barium sulphate, 25% zinc sulphide and the balance zinc oxide. Moreover the addition of barium sulphate to white lead increases the lasting power of the paint and enables it to take colour stain more uniformly, it is therefore valuable as a base for conveying pigments.

Although no barytes has been mined in the province of Quebec for several years, a deposit was worked formerly in the township of Hull, and other deposits are known to exist.

The essential quality of barytes for pigment purposes is freedom from deleterious impurities which discolour it. Very small quantities of such impurities as iron oxide are sufficient to stain the barytes and render it unfit for use in the manufacture of paint without special preliminary treatment.

Quotations for ground barytes are of the order of $20 per ton.

Titanium white.

Although the large deposits of titaniferous iron ores which occur in the province of Quebec cannot be used as a source of iron under the conditions at present prevailing in the steel industry, the high percentage of titanium oxide which they contain may render them suitable for the manufacture of a white pigment which has lately been put on the market under the name of " Titanium white ".

According to the technical press titanium white, or titanium hydrate, appears likely to take an important place in the paint industry, and to replace, in a measure, the white lead, which fills such an important role in the manufacture of paints. Titanium white has a very high index of refraction, and consequently high covering power ; it is not poisonous ; and with linseed oil it gives a paint which is not acted upon by sea water. One kilogram of titanium white, it is claimed, can cover 20 square meters, whereas one kilogram of white lead covers only 9.1 square meters.

The titanium white is prepared by pulverizing ilmenite, a natural oxide of iron and titanium, and treating it with hot commercial sulphuric acid, forming sulphates of iron and of titanium, which are soluble in water. On ebullition the titanium hydrate is precipitated. This is neutralized by barium carbonate and calcined.

The Titanium Pigment Co. is operating a plant at St-Louis, which treats ilmenite from Pablo Beach, containing about 52% TiO_2

Commercial quantities are also produced at Frederickstad in Norway.

The drawback to the wider use of this pigment has been its high cost. Unless the ore is comparatively rich the cost of the chemicals used in the treatment is prohibitive. A second reason for the high cost is the difficulty experienced in removing the last traces of iron, which would of course discolour the pigment, were they not eliminated. On the other hand further research and experimentation have proved that a composite pigment consisting of only 25% of the white titanium hydrate thrown down on a base of precipitated barium sulphate, probably because of the wonderful fineness of the particles and maximum distribution of the titanic oxide, had approximately 80 per cent of the hiding power of a pigment consisting of 100 per cent titanic oxide.

A process has recently been developed on a laboratory scale, which is particularly suited to Canadian conditions, and by which electrolytic iron and titanium white could be produced from the ilmenite. It is reported that the process will be tested, on a commercial scale, on ore from the Ivry ilmenite deposits, which are situated about 70 miles north of Montreal.

Natural Gas.

The southern portion of the province of Quebec, south of the St. Lawrence between Montreal and Quebec, as well as a narrow fringe north of this river, are underlain by rocks of Paleozoic age in which the presence of natural gas was recognized as far back as the middle of the nineteenth century, but no attempt was made to search for it on a large scale until 1886, when a company was formed to bore wells for gas on the island of Montreal, and at Louiseville on the north shore of the St. Lawrence river. One well was put down in Montreal to a depth of 1100 feet and four at Louiseville. The Louiseville wells yielded some gas for a short time, which was used under the boilers of the water works of the town.

In 1907 another company drilled wells in the same district, laid down pipe lines and for about a year supplied gas to the towns of Yamachiche, Louiseville and Trois-Rivières, but the supply soon gave out.

Between 1911 and 1913 boring operations were carried on in search of gas in the St. Hyacinthe district, south of the St. Lawrence river. Gas was struck in several places, but not in sufficient quantities to exploit it on a remunerative scale.

Peat.

Peat is formed by the natural accumulation of vegetable matter, in, or in the presence of water, under conditions which prevent its complete decay and destruction. It is in bogs that the propitious conditions are realized on a large scale and as successive growths of plant life (mainly mosses) follow one another, the roots and dead matter, preserved from the air by being soaked in the water of the imperfectly drained swamp, partially decay and give rise to a more or less pulpy mass known as peat, which in many countries is excavated and dried, to make a low grade, but very useful fuel.

In the settled parts of the province of Quebec there are 500 square miles of peat bogs having an average thickness of 8 to 10 feet.

This peat contains about 90% of water but when this is removed the residue may constitute a very satisfactory fuel. The possibilities of the use of Canadian peat as fuel were exhaustively studied by a special committee, whose conclusions were published by the Department of Mines, Ottawa.

None of the bogs in the province of Quebec are at present being worked although recently a plant was being erected to exploit a bog near Garneau junction. Unfortunately a fire destroyed this plant before it was put into operation.

Petroleum.

The occurrence of oil bearing springs in the eastern part of Gaspé peninsula, in the lower part of the basins of the York and Dartmouth rivers, attracted the attention of Sir William Logan, the first director of the Geological Survey of Canada, who mentions them in a report published in 1845. Several borings were put down in the course of the next thirty years, but without attaining any practical results.

During the decade 1890 to 1900 several companies prosecuted work on a large scale, and during that time 52 wells were sunk, some to a depth of 3,700 feet. In several of the wells fair shows of oil were struck, in rocks regarded as being of Devonian age, but no large quantities of petroleum were obtained.

The greater part of the province of Quebec, it has already been stated, is underlain by igneous and greatly metamorphosed rocks of Precambrian age, which practically precludes the presence of petroleum. On the other hand the sedimentary rocks of the St. Lawrence Lowlands might well be expected to yield small quantities. The disturbed region affected by the Appalachian folding and faulting is not favourable to the accumulation of oil pools.

Apatite or Phosphate of Lime.

Phosphate of lime, in the shape of crystalline apatite, occurs in veins and pockets in granitic gneisses, pyroxenites and crystalline limestones, in the basin of the Lièvre river, north of the Ottawa river, some 25 miles below the city of Ottawa. Although they are irregular these apatite deposits are nevertheless large and numerous, and between 1880 and 1892 they were the object of active mine operations and of a flourishing industry.

But the discovery of the large bedded phosphate deposits of Florida and Tennessee, which can be exploited for a fraction of the cost of production of the Lièvre apatite, very soon caused a complete cessation of work of the latter deposits, which however constitute a reserve which will again assume importance in years to come, after the southern deposits are exhausted. At present the Quebec production of phosphate of lime is limited to a few tons of apatite yearly, extracted as a by-product in the course of mica mining.

Talc.

Although occurrences of pure talc have been observed in the Province of Quebec they have never been worked, or even sufficiently investigated to prove whether or not they were workable. On the other hand deposits of steatite, or soapstone, the massive and less pure variety of talc, have at various times been opened for various purposes such as stove and furnace linings ; paper filler when ground ; as a component for cheap paints and other uses.

Soapstone deposits are found associated with the rocks of the serpentine belt, in the counties of Brome, Richmond, Megantic, Beauce. The only one being worked at present is at Robertsonville, where the soapstone is quarried and cut into blocks and shapes used to line alkali recovering furnaces in the pulp mills using the sulphate process. These brick stand temperatures of 2000 degrees Far. and resist fused sodium sulphide. Chrome brick also fulfill these conditions, but the talc blocks are much cheaper.

" Deposits of fine, grey talc occur at a number of localities in the Eastern Townships of Quebec, notably near Knowlton and Robertson. The Robertson material has been mined in a small way for cutting into furnace blocks but no grinding has yet been undertaken. The Quebec talc seems equal, if not superior to many of the commercial grey Vermont talcs, which are imported into Canada, and could probably replace such talc advantageously; there should be a large enough domestic demand for talc of this type to warrant the erection of a grinding mill in the above district." (1)

Ground talc except of the finest grades is a low priced product, selling for $8 to $20 per ton. The very fine toilet grade talcs, and the massive cut-to-shape material command much higher prices.

The production for the last three years in the province of Quebec has been, mostly of blocks and shapes :

1924	449 tons	valued at	$20,273
1925	693 "	" "	30,130
1926	885 "	" "	38,209

BUILDING MATERIALS (2).

The value of the production of building materials, from the working of stone quarries, clay pits and sand pits, constitutes more than one half of the mineral production of the province of Quebec. For the year 1926 this value amounts to $13,004,929. The list

(1) Investigations of Mineral Resources and the Mining Industry 1924. Mines Branch, Department of Mines, Ottawa.

(2) By Henri Gauthier.

of the products comprises : limestone, granites of various textures and colours, sandstone, marble, slate, clay-brick, shale-brick, cement, lime, sand.

In the Province of Quebec quarrying is connected, to some extent, with the improvement of city streets and rural roads but above all it develops in proportion to the increase of our own building industry. The exportation of construction materials or ornamental stones which in certain countries is a great support of quarrying is almost unknown in our Province, granite from Stanstead and marble from Missisquoi being practically the only materials shipped to other provinces of the Dominion.

Limestone.

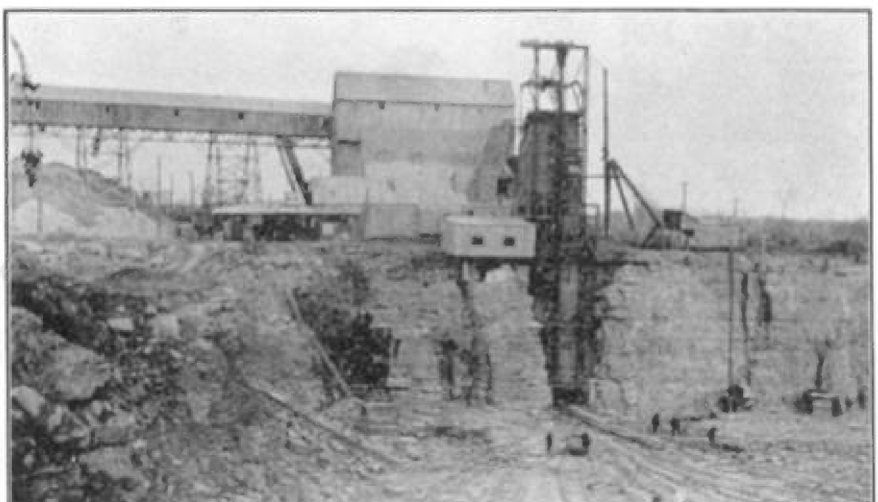
Deposits of limestone capable of supplying unlimited quantities of building stone, stone for road-making, raw material for the manufacture of lime and cement, for use in the manufacture of wood pulp for paper, are found widely distributed in practically all settled parts of the Province The Trenton, the Chazy and the Calciferous formations, all of Ordovician age, supply most of it, and quarries are opened in many places on the Island of Montréal ; on Ile Jésus ; in the vicinity of Quebec ; at St. Marc-des-Carrières ; Joliette ; Hull ; St. Hyacinthe ; Dudswell and many other places.

Besides the Ordovician limestones, the crystalline limestones of Precambrian age, which are metamorphosed limestones of the Grenville formation, are found widely distributed over the settled southern edge of the Laurentian plateau. These crystalline limestones are usually magnesian and are mostly dolomitic in composition.

Silurian limestones are found on the east shore of lake Temiscouata, in the basin of the lake and valley of the Matapedia and also at Port Daniel.

At Burnt island, in lake Temiscamingue, strata belonging to the Niagara formations are exposed, while at Gaspé Point there is limestone of the Devonian period to which the name of Grande Grève formation has been given. These three limestones have been occasionally quarried to a small extent only.

A granite quarry at Stanstead.



Limestone quarry and stone crushing plant, Montreal.

There are many buildings constructed of limestone in the cities and towns in the province of Quebec, but Montreal is above all the place where such stone has been used. Besides the majority of residences and many commercial and public buildings, the principal churches and chapels have been built of the local limestone.

Cut stone was in great favour as stone for house building until the end of the last century, but to-day, owing to the high cost of dressing, preference is given to brick and artificial stone ; nevertheless large quantities of limestone are still quarried and dressed each year for use in the better types of commercial houses, public buildings, churches, and for bridge piers.

The chief quarrying centers of limestone for architectural work and dimension stone have been for many years St. Marc des Carrières in Portneuf county, St. François de Sales and Cap St. Martin, on Isle Jésus.

With the constantly increasing use of cement concrete in all kinds of constructions the demand for crushed stone to be used as aggregate becomes greater every year. The crushed stone business is closely connected, apart from cement concrete constructions, with city street paving. For this reason we find quarries equipped with crushing plants within a short distance of the large urban centers which are the principal consumers.

Rural road improvement and maintenance, and railroad ballasting also absorb each year large quantities of crushed stone. Over two-thirds of the total tonnage of limestone quarried is crushed.

Granite.

The granite resources of the Province of Quebec are large, and considerable quantities of ornamental high grade building stone, curbstone, and paving blocks are produced each year.

The production of some 30 quarries in operation during the year 1926 amounted to $873,962.

The grey granites of the Appalachian chain in the Eastern Townships are known throughout the whole Dominion. They are extensively quarried at Graniteville and Beebe, in Stanstead county, some 30 miles south of the city of Sherbrooke, and at St. Sébastien and St. Samuel Station, north of Megantic. Both of these areas produce a very similar stone, a warm grey granite of medium, even grain, of which the constituents, in order of importance are, orthoclase, plagioclase (albite), quartz, biotite, and a little hornblende. These grey granites take a high polish, and they are used both as building stone and as stone for monuments. The Stanstead granite masses are excellently sheeted and jointed, the rift and grain are well developed. Large quarries are possible and the shipping facilities good. There were in 1926 nine firms shipping stone from Beebe and Graniteville, the principal producing centers. Some of these firms have large and very modern works where stone-cutting and the polishing of granite are done by mechanical methods. The colonnades on the front of the municipal library and of the new Court House of Montreal are excellent examples of the work done there. There are also important quarries at Graniteville. Granite for the construction of the new basilica of Ste-Anne de Beaupré comes from quarries at St. Samuel Station.

Among other places where grey granite suitable for building purposes occurs in the Eastern Townships may be mentiond Point Magoon on Lake Memphremagog, Stanhope in the county of Stanstead, Orford Mountain in Sherbrooke, Danville, near Richmond.

" Black granite " is a trade term used to designate dark coloured igneous rocks quarried in some of the Monteregian hills, such as Mount Johnson, Brome mountain, Mount-Royal, where the stone is composed of plagioclase, hornblende and a pyroxene, with or without quartz. These rocks which are more akin to diorites are darker and coarser grained that the Stanstead granites. At present the only hill in which quarrying is carried on is Mount-Johnson, where stone mostly used for monuments is obtained.

Granitoïd rocks of various colours, black, grey, pink, red and of all grains from very coarse to even and fine grain, including granites, syenites, granite-gneisses and anorthosites, are found and quarried in the Laurentian hills, north of the St. Lawrence.

The more important producing quarries in the Precambrian rocks are those of Guénette, 16 miles south of Mont-Laurier ; of Brownsburg in Argenteuil county ; of Rivière-à-Pierre in Portneuf county ; and of Roberval on lake St. John.

The Guénette granite, known to the trade as " Canadian Pink ", occurs in a batholith of large dimensions and can be quarried in blocks of almost any dimensions. It is rather hard to work but takes a fine polish. The stone is fine grained and light red in colour. It is largely used for paving blocks but during the past six years approximately 200 press rolls have been furnished to paper mills. These rolls when finished varied in dimension from 18 inches up to 30 inches in diameter and from 7 feet up to 22 feet in length. They are finished at a modern dressing plant at Iberville, near St. Johns.

The Brownsburg quarries are situated in the township of Chatham. They are worked in massive bodies of coarse granite of uniform texture consisting of feldspar, of hornblende, and a varying amount of quartz. The stone varies in colour from light greenish grey to pink and chocolate. It is mostly used for monuments, and as building material. During the past years large quantities of blocks were made for paving the streets of the city of Montreal. This stone is very well suited for the turning of columns as may be seen at the Hochelaga Bank building at Three-Rivers.

The granite of Rivière-à-Pierre is especially suitable for making dimension stones. This granite was used in constructing the piers of the Quebec Bridge. It is very coarse-grained in texture. Large crystals of red feldspar are abundant as is also the percentage of the black elements. It varies from a greyish to pinkish colour according to the proportions in which these elements occur. Among others the church of St. Cœur de Marie in Quebec clearly shows its adaptibility to large buildings.

At Roberval, lake St. John, very coarse grained granite which contains a profusion of red orthoclase crystals is produced from a quarry 2½ miles north west of the town. This granite has been used in the construction of many buildings in Quebec, Chicoutimi and Roberval. The church of St. Prime, the city hall at Roberval are monuments built with the Roberval granite.

Marble.

The Quebec marble may be divided into two groups (a) those belonging to the Precambrian era, (b) those of the Paleozoic era.

Precambrian marbles are found chiefly as metamorphic beds in the Laurentian plateau, and in the Eastern townships where marble outcrops in the denuded anticlinal folds of the Appalachian mountains. The former consist of bands of crystalline limestones of Grenville age and are of common occurrence in all the counties forming the southern part of the Laurentian highlands. The latter, which are crystallized sediments of the early Paleozoic, occur in Shefford county and at Mount Orford.

The crystalline limestones and dolomites of the Laurentian plateau are really marbles, but the grain is almost always so coarse that they do not lend themselves to ornamental uses, and are considered more as building stones. They are however very white and can take a fair polish.

At Ste-Thècle attempts have been made to work a large band of white and salmon pink marble. Unfortunately its commercial value is greatly impaired by the coarseness of its grain and by the many inclusions of dark rocks which it contains.

At South Stukely, in Shefford county, operations were carried on for some years on a quarry which yielded marbles of pale and deep shades of yellow, pink and violet colours.

Paleozoic marbles are found in the counties of Missisquoi, Shefford and Wolfe. In the vicinity of Philipsburg on Missisquoi Bay, there is an area of metamorphic limestone of the Ordovician period. The marble known in the trade under the name of "Missisquoi" is taken from these strata. The stone is fine grained and very pleasantly variegated, mottled and banded in greyish, cream, green and rose colours. These marbles have been used for the interior decoration of numerous large buildings, not only in the province of Quebec but also in Ontario and the Western provinces.

To-day, the Philipsburg quarries produce all of the domestic building and decorative marble in this province.

Crushed and graded white crystalline limestone and dolomite commercially known as marble are also produced in fairly large quantities for stucco work and terrazo flooring at Portage du Fort in Pontiac county.

Sandstone.

Owing to the wealth of granites and limestones, which are found almost everywhere in the province, the sandstone outcrops which are less numerous, have been somewhat neglected as a source of building stone.

The Potsdam sandstone, a hard and generally white stone of Cambrian age, underlies a great part of the counties of Two-Mountains, Soulanges, Vaudreuil, Beauharnois, Huntingdon, to the west of Montreal.

The stone is, as a rule, mainly composed of rounded grains of quartz sand, but varies greatly in different districts both in texture and composition. Some beds are rusty owing to oxide of iron and assume slight tints of yellow and brown which produce pleasing effects.

At Beauharnois several houses have been built of Potsdam sandstone from the neighbouring quarries. In late years very little of this stone has been quarried for building purposes. It is employed however to a certain extent for road metal. Paving blocks also have been cut from a fissile variety of this sandstone which occurs near St. Scholastique in Two-Mountains county.

This stone is sufficiently pure, in places, to be used for glass manufacture.

A quarry on Potsdam sandstone is operated at St. Canut in Two-Mountains county, and produces silica sand. The stone after crushing, is washed, dried and screened. The product is used in Montreal and elsewhere for the manufacture of bottle glass, for steel foundry work, and for furnace linings.

In the vicinity of Quebec city, Sillery sandstone, which is slightly more recent in age than the Potsdam, outcrops on both sides of the St. Lawrence river, and has been quarried rather extensively. This sandstone is yellowish, greenish and reddish in colour. It consists of grains of various sizes of quartz and feldspar, bound by a clayey paste. The deep green coloured variety occurring west of Quebec was formerly in great demand as building stone. These standstones when contrasted with light grey limestone in house buildings give a beautiful effect.

The Quebec citadel, the fortification walls, Notre-Dame du Chemin Church are built of Sillery sandstones as well as several large buildings in the city.

As a road metal the Sillery sandstone compares favourably with the most durable kinds of rock that can be obtained in the province. It is tough, binds well, and is resistant to moisture.

It is quarried at the present time for road metal and concrete aggregate at Sillery, west of Quebec, at Levis, St. David and St. Romuald on the south shore of the St. Lawrence river.

On the east shore of Lake Temiscamingue yellowish green Niagara sandstone was quarried for the Presbyterian church at Haileybury.

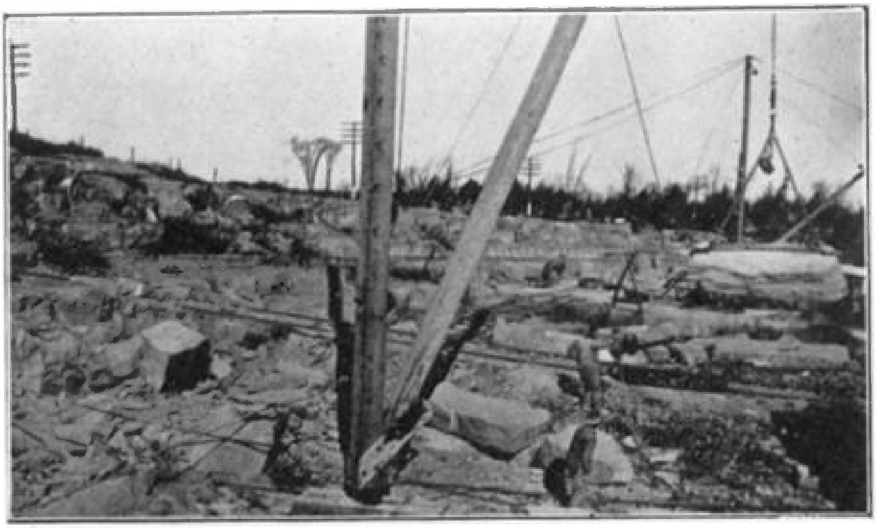
In the Gaspé Peninsula occur sandstones of Devonian age. This stone is of a fine and uniform grain of a very attractive red brown colour. On the banks of the Baie des Chaleurs in Bonaventure, there is a sandstone of olive green colour which has been used in building the church at Mission Point on the Restigouche River opposite Campbellton, N. B.

Slate.

All the slate quarries known in the Province of Quebec are situated on the South shore of the St. Lawrence. They are found in the chains of mountains forming the prolongation of the Appalachians through that part of the Province.

The Quebec slates belong to the Cambrian and Ordovician formations. They are generally found near intrusions of serpentines.

The Cambrian slates are red, green, violet or speckled. They outcrop especially in the regions of Granby, Acton, Kingsey,



Limestone quarry.—St-François de Sales.

A battery of modern lime kilns at Deschambault.

Brompton, Garthby, Frampton as well as in proximity to the Ordovician deposits of Melbourne. The Ordovician slates are of dark colours varying from bluish grey to bluish black. The chief quarries are those in the regions of Melbourne, Cleveland, Danville, Brompton, Orford, Halifax, and Glendyne in Temiscouata.

The deposits in Richmond county, where the bluish black variety of Ordovician slate occurs, have been worked most. Quarries have been operated there for nearly three quarters of a century. They have produced roofing slate every year until 1923, but on a small scale. The beds in these deposits have been much disturbed and the waste in quarrying is large, rendering operations rather costly.

Clay and Shale Deposits.

Clay deposits of post-glacial age and thick shale beds of Ordovician age occur practically everywhere in all the southern settled part of the Province and are widely used for the manufacture of brick of all kinds, tiles, hollow buildings blocks and other clay products.

The total value of brick produced in the Province in 1926 from domestic clays and shales was $2,256,856. The chief centre of the brick-making industry is at Laprairie, 14 miles west of Montreal; at both Laprairie and Delson junction there are several plants with a capacity of output of 20,000 bricks per hour. At these two places the plastic shales of the Utica-Lorraine formation are worked. These underlie a considerable part of the county of Laprairie. They occur as thin horizontal beds interstratified with others more or less silicious. The rock is very friable which makes it easy to work with a steam shovel.

Besides the brick-yards of Laprairie and Delson, shale brick is also made on a large scale at Boischatel, near the City of Quebec.

There are other important brick-yards in the Province of Quebec, all of which use clay as raw material. Moreover in the county of Matane there are shales of the Levis and Sillery formations possessing vitrifying qualities. These shales have a high fusing point and with them bricks for paving and sewer pipes can be made. However, these are not worked at the present time.

Cement.

The manufacturing of Portland cement is to-day one of the important industries of the Province. Although it dates from 1890, it is really only since 1905 that this industry began to develop to eventually reach a culminating point in 1926.

With four plants in operations, the sales of cement for the year 1926 totalled, 3,727.477 barrels valued at $4,535,386.

The plants in operation are situated at Montreal East, Hull and St. François de Sales.

The plants at Montreal East, which are the largest ones, utilize the dry process and are equipped with rotary kilns. Limestone of the Trenton formation is the cement rock used. It is argillaceous, and constitutes an ideal natural mixture, requiring no addition of calcium carbonate.

Lime.

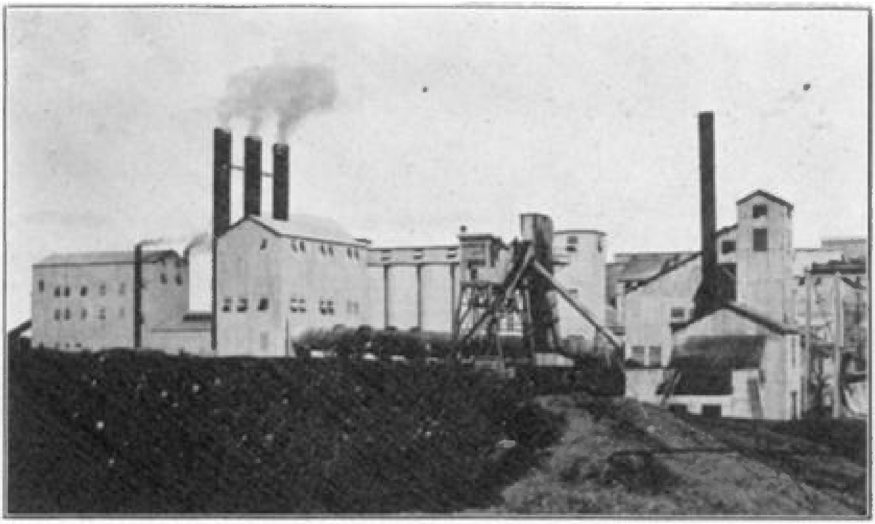
A considerable part of the lime produced is used in the building trades, but the chemical industry is now the most important customer of the lime kilns. The old intermittent wood-burning stone-kilns are now replaced in the Province by modern continuous steel kilns of large output, fired with coal or by producer-gas. Practically all of our lime is produced from high-calcium limestone of the Trenton and Chazy formations.

There are important lime producers at Joliette, St. Marc-des-Carrières and Lime Ridge. There are also large lime plants in Hull and in Montreal.

A total of 2,852,279 bushels of quick lime of a selling value at the kilns of $756,117, was produced in 1926.

Sand.

The production of sand is closely connected with the building industry and while each year large quantities are used in municipal paving work and in the construction and maintenance of highways and rural roads, during periods of building activity in the cities it represents, in tonnage, a fairly large proportion of the building materials produced in the Province.



A modern cement plant, at Montreal East.

Brick Kilns at Scott Junction.

There are many deposits of sand and gravel in Quebec. Their economic value varies greatly, depending on the locality where they occur and the place where the material is to be used, and also on the facilities of transportation.

The chief centres of sand production are the districts of Joliette and of South Durham. Sand is also obtained on a large scale from the beds of lake of Two-Mountains and from the St. Lawrence River at Three-Rivers and Quebec.

According to statistics the amount of sand and gravel used in the Province in 1926 had reached the figure of nearly 5,500,000 tons estimated at $1,452,574.

LIST OF OCCURRENCES OF ECONOMIC MINERALS IN THE PROVINCE OF QUEBEC

Note.—The following list of known occurrences of economic minerals does not claim to be complete, but is sufficient to show the wide distribution of minerals in the province. These occurrences comprise mines actually producing ; mines which have produced in the past, but are closed down at present ; deposits on which more or less prospecting work has been done ; and mineral showings which, judging from the outcrops, may be worthy of further investigation. The list is geographical, being compiled by counties, and by townships when possible.

ABITIBI COUNTY AND TERRITORY

Barraute	**Chalcopyrite, free gold, pyrite.**
Bourlamaque	**Chalcopyrite, free gold, pyrite.**
Bousquet	**Magnetite.**
Cadillac	**Arsenopyrite, chalcopyrite, free gold, magnetite, pyrite, pyrrhotite.**
Cléricy	**Chalcopyrite, free gold, fuschite, pyrite (auriferous), sphalerite.**
Dalquier	**Chalcopyrite, pyrite, sphalerite.**
Desmeloizes	**Chalcopyrite, pyrite, silver, sphalerite, gold.**
Destor	**Auriferous pyrite, chalcopyrite.**
Dubuisson	**Chalcopyrite, free gold, pyrite, pyrrhotite, scheelite.**
Dufresnoy	**Arsenopyrite, chalcocite, chalcopyrite, gold, silver, pyrrhotite, sphalerite.**
Duparquet	**Chalcopyrite, galena, gold, pyrite, sphalerite.**
Duprat	**Chalcopyrite, gold, pyrite, pyrrhotite, sphalerite.**
Fournière	**Chalcopyrite, pyrite, gold.**
Guyenne	**Iron formation, silver.**
La Corne	**Molybdenite.**
Lake Mistassini	**Galena, sphalerite.**
Landrienne	**Gold, pyrite.**
Malartic	**Chalcopyrite, galena (argentiferous), molybdenite, pyrite.**
McKenzie	**Asbestos, chalcopyrite, gold.**
Montbray	**Arsenopyrite, chalcopyrite.**
Obalski	**Arsenopyrite, chalcopyrite.**
Obalski River	**Chalcopyrite.**
Preissac	**Beryl, bismuthinite, chalcopyrite, galena, molybdenite, pyrite, sphalerite.**
Roquemaure	**Gold.**

Roy ....Asbestos, chalcopyrite, gold, magnetite ouvarovite, pyrite, pyrrhotite.
Scott ....Gold.
Shabogama Lake ....Pyrite.
Trécesson ....Chalcopyrite, free gold, galena, pyrite, silver, sphalerite.
Varsan ....Gold.

ARGENTEUIL

Arundel ....Mica.
Chatham ....Apatite, granite, mica, tourmaline.
Chatham Gore ....Graphite, marble.
Grenville ....Apatite, graphite, limestone, magnesite, magnetite, mica, ochre, peat, serpentine, zircon.
Grenville Augmentation ....Asbestos, graphite, magnesite.
Harrington ....Graphite, magnesite, marble, marl, mica, peat.
Lachute ....Andesine, marble, marl.
Wentworth ....Apatite, asbestos, graphite, magnesite, marl, mica.

ARTHABASKA

Chester ....Copper minerals, iron, galena.
Horton ....Alluvial gold.
Stanfold ....Limonite.
Tingwick ....Chalcopyrite, asbestos.

BAGOT

Acton ....Anthraxolite, bornite, chalcopyrite, cuprite, galena, slate.
St-Dominique ....Limestone.
St-Hyacinthe ....Peat.
Upton ....Chalcopyrite, limestone.

BEAUCE

Aubert-Gallion Seigniory ....Alluvial gold, manganese.
Aubert de l'Isle Seigniory ......Alluvial gold.
Broughton ....Asbestos, chromite, talc.
Jersey ....Alluvial gold, vein gold, slate.
Linière ....Alluvial gold, vein gold.
Metgermette South Seigniory ..Alluvial gold, vein gold.
Rigaud-Vaudreuil Seigniory ....Alluvial gold, arsenopyrite, asbestos, galena, gold, granite, limonite, serpentine, titaniferous magnetite.
Ste-Marie Seigniory ....Manganese.
Rivière-du-Loup ....Gold, iridosmine, platinum, rutile.
St-Joseph Seigniory ....Manganese, marble, shale.
Shenley ....Alluvial gold.
Tring ....Manganese, slate.

BEAUHARNOIS

Beauharnois .... Limestone.
Marystown .... Sandstone.
Melochville .... Quartzite.

BELLECHASSE

Mailloux .... Galena.
St-Charles .... Shale.
St-Valier .... Limonite.

BERTHIER

Brassard .... Apatite, beryl, graphite, magnetite.
De Maisonneuve .... Apatite, fergusonite, feldspar, muscovite, samarskite.
Lanoraie .... Peat.
Milieu R. .... Apatite, mica.
Prévost .... Apatite, garnet, graphite, magnetite.
St-Cuthbert .... Limestone.

BONAVENTURE

Carleton .... Iron ochre.
Cox .... Marl.
Hamilton .... Marl.
Mann .... Sandstone.
Port-Daniel .... Barite, limestone, marble.
Restigouche .... Limestone, sandstone.

BROME

Bolton .... Asbestos, chalcopyrite, chromite, cobalt & nickel, fuchsite, magnesite, manganese, pyrite, pyrrhotite, sphalerite, talc.
Brome .... Chalcopyrite, granite, hematite, slate, titaniferous magnetite.
Potton .... Chalcopyrite, galena, limonite, mineral water, pyrrhotite, silver, talc, kaolin.
Sutton .... Copper ores, hematite, magnesite, manganese, rutile, slate, talc, titaniferous magnetite.

CHAMBLY

Chambly .... Mineral water.
Longueuil .... Peat.
St-Hubert .... Peat.
St-Lambert .... Brick shale.

CHAMPLAIN

Batiscan River	Limonite.
Batiscan Seigniory	Iron sands.
Cap de la Madeleine	Limestone, mineral water, ochre.
Champlain Seigniory	Iron sands, peat.
Dessane	Magnetite.
Lanaudière Seigniory	Graphite.
Lavallée	Graphite.
Normand	Allanite.
Polette	Limestone, marble.
Radnor	Apatite, graphite, limonite, ochre, peat, titaniferous magnetite.
Ste-Anne Seignory	Ochre.
Ste-Anne de la Pérade	Mineral water.
St-Luc	Peat.
St-Prosper	Peat.
St-Tite Parish	Marble.
Weymontachingue	Syenite.

CHARLEVOIX

Baie St-Paul	Mineral water, galena.
Cap à l'Aigle	Sandstone.
Côte de Beaupré Seigniory	Allanite, barite, fluorspar, galena, graphite, ilmenite, iron sands, marble, rutile, sapphirine.
Du Gouffre Seigniory	Ilmenite.
Lacoste	Feldspar, garnet, muscovite, radioactive minerals, uraninite.
Les Eboulements	Mineral waters.
Malbaie	Limestone, sandstone.
Murray Bay	Fluorite, mineral water.
St-Irénée	Galena, garnet.
St-Urbain	Ilmenite, rutile, titaniferous magnetite.

CHATEAUGUAY

Edwardstown	Peat.
Ormstown	Quartzite.
Russeltown	Quartzite.
Ste-Martine Parish	Mineral water.

CHICOUTIMI

Bourget	Muscovite, titaniferous magnetite.
Jonquière	Bismuthinite, beryl, mica, molybdenite.
Kénogami	Molybdenite, titaniferous magnetite.
Pontbriand	Muscovite.
Simard	Ochre.
Taché	Allanite, gadolinite.

COMPTON

Auckland	Alluvial gold.
Ditton	Alluvial gold.
Westbury	Alluvial gold, vein gold, slate.

DORCHESTER

Cranbourne	Asbestos, bornite, chalcopyrite.
Frampton	Slate.
Lauzon Seigniory	Native copper.

DRUMMOND

Durham	Chalcopyrite, ochre.
Kingsey	Slate.
Simpson	Limonite.
Wickham	Copper sulphides.

FRONTENAC

Adstock	Asbestos.
Chesham	Alluvial gold.
Gayhurst	Granite.
Lambton	Alluvial gold, vein gold.
Marlow	Alluvial gold, galena, vein gold, pyrite, scheelite, silver, sphalerite.
Marston	Chalcopyrite, vein gold, pyrite.
Risborough	Alluvial gold, galena (argentiferous), vein gold, pyrite, sphalerite.
Spaulding	Hematite, magnetite, manganese.

GASPE

Baie des Chaleurs	Agate.
Blanchet	Asbestos.
Cap Chatte	Anthraxolite.
Cap des Rosiers	Agate, galena.
Christie	Galena, sphalerite.
Galt	Asbestos, petroleum.
Gaspé Bay South	Petroleum, mineral water.
Larocque	Petroleum.
Lemieux	Chalcopyrite, galena, hematite, malachite, marcasite, pyrite, sphalerite.
Madeleine River	Pyrrhotite.
Mount Albert	Asbestos, chromite, serpentine.
Newport	Chalcocite, chalcopyrite, cuprite, hematite, malachite.
Pabos Seigniory	Hematite.
York	Asphaltum, limonite, petroleum.
York River	Chalcopyrite.

HULL

Aumont	Amber mica.
Aylwin	Mica, muscovite.
Bouchette	Apatite, feldspar, amber mica, muscovite, sphalerite.
Cameron	Magnetite, mica.
Denholm	Apatite, asbestos, galena, mica.
Eardley	Apatite, magnetite, mica, molybdenite, ochre.

Egan ....Mica, molybdenite, muscovite.
Hincks ....Apatite, asbestos, mica, muscovite.
Hull ....Apatite, amazonite, barium sulphate, diopside, feldspar fluorite, graphite, jasper, hematite, limestone, magnetite, marble, mica, molybdenite, muscovite, ochre, titaniferous magnetite.
Low ....Graphite, mica, muscovite.
Lytton ....Mica.
Maniwaki ....Feldspar, limestone, marble, mica.
Masham ....Marl, mica, molybdenite.
Northfield ....Biotite, graphite mica.
Templeton ....Apatite, asbestos, barite, diopside, feldspar, galena, hematite, limonite, magnetite, mica, rutile, sandstone, zircon.
Templeton Gore ....Diopside, feldspar, mica.
Wakefield ....Apatite, asbestos, feldspar, fluorite, garnet, graphite, gummite, limestone, lepidolite, magnetite, marl, mica, muscovite, spinel, tourmaline, uraninite.
Wright ....Asbestos, mica, muscovite.

IBERVILLE

St-Brigide .... Peat.
St-Grégoire-le-Grand Parish ... Granite.

JOLIETTE

Cartier ....Apatite, marble.
Cathcart ....Marble.
D'Aillebout Seigniory ....Nickel & cobalt, pyrite.
D'Argenteuil Seigniory ....Garnet.
De Ramsay Seigniory ....Garnet.
Joliette ....Limestone, mineral water.
Kildare ....Garnet, limonite, marble, ochre.
Kildare Gore ....Pyrrhotite.
St-Félix de Valois ....Limonite.
Tracy ....Gold.

KAMOURASKA

L'Islet Plat St-Germain ....Mineral water.
Riviere aux Vaches ....Limonite.
Rivière Ouelle ....Jasper, mineral water, peat, phosphate.
Ste-Anne de la Pocatière ......Manganese, mineral water.
St-Pascal ....Limonite.
Woodbridge ....Barite, galena.

LABELLE

Amherst .... Graphite, kaolin, quartzite.
Bigelow ....Apatite, mica.
Blake ....Mica, ochre.
Bowman ....Apatite, graphite, mica.
Boyer ....Graphite.

Buckingham	Apatite, barite, cassiterite, feldspar, graphite, magnetite, mica, quartzite.
Campbell	Granite.
Clyde	Albite, garnet, graphite.
Derry	Apatite, datolite, faujasite, feldspar, fluorite, mica, silica.
Joly	Garnet, graphite.
Lathbury	Graphite.
Lochaber	Apatite, graphite.
Marchand	Ochre.
McGill	Apatite.
Mulgrave	Asbestos.
Petite Nation Seigniory	Graphite, sandstone.
Portland East	Apatite, dental spar, feldspar, garnet, mica.
Portland West	Apatite, asbestos, garnet, gummite, graphite, mica, microcline, uraninite.
Ripon	Apatite, mica.
Villeneuve	Apatite, beryl, cerite, dental spar, feldspar, fluorite, gummite, mica, monazite, muscovite, pitchblende, quartz, samarskite, tourmaline.
Wells	Apatite, mica.
Wentworth	Marl.

LAKE ST. JOHN

Mistassini River	Mica, muscovite.
Péribonka	Muscovite.
Pointe Traverse	Bituminous shales.
Alma Island	Granite, titaniferous magnetite.
Caron	Limestone.
Grande Ligne	Limestone.
Labarre	Granite, anorthosite.
Métabetchouan	Limestone.
Ouiatchouan	Limestone.
Pointe Bleue	Limestone.
Roberval	Granite, limestone.
St. John Parish	Limestone.

L'ASSOMPTION

Charlemagne	Shale.
L'Epiphanie	Peat, shale.
St-Henri de Mascouche	Natural gas.

LAVAL

Isle Jésus	Limestone.

LEVIS

Lévis	Mineral water.
Point Levis, St-Nicolas	Anthraxolite.
St-David de l'Aube Rivière	Sandstone.
St-Jean Chrysostôme	Sandstone.
St-Joseph	Shale.
St-Lambert	Limonite.

L'ISLET

L'Islet .... Sandstone.

LOTBINIERE

Gaspé Seigniory .... Coal, manganese.
Lotbinière Seigniory .... Ochre.
St-Antoine de Tilly .... Shale.
Ste-Croix Seigniory .... Chalcopyrite.
St-Flavien .... Chalcopyrite, anthraxolite.
St-Giles de Beaurivage .... Alluvial gold, chalcopyrite, manganese.

MAGDALEN ISLANDS

Alright Island .... Limonite.
Amherst Island .... Gypsum, manganese.
Coffin Island .... Gypsum.
Entry Island .... Limonite.
Grindstone Island .... Gypsum, pyrolusite.

MASKINONGE

Laviolette .... Ochre.
Louiseville, Parish .... Natural gas.
Maskinongé .... Mineral water.
St-Justin .... Infusorial earth.
St-Léon .... Mineral water.

MATANE

Causapscal .... Limestone, sandstone.
McNider .... Manganese, mineral water, peat.
Matane .... Marl, peat, chalcopyrite, native copper.
Matapédia Lake Seigniory ...... Limestone.
St-Denis .... Anthraxolite, native copper.

MEGANTIC

Coleraine .... Asbestos, chromite.
Halifax .... Copper sulphides, slate.
Inverness .... Chalcopyrite. hematite, limonite, pyrrhotite.
Ireland .... Alluvial gold, asbestos, chalcopyrite, chromite, limonite, pyrrhotite, talc.
Leeds .... Alluvial gold, asbestos, bornite, chalcocite, chalcopyrite, chromite, vein gold, magnetite, talc.
Nelson .... Copper minerals.
Thetford .... Asbestos, chalcopyrite, chromite ,talc.

MISSISQUOI

Dunham ....Hematite.
Farnham ....Shale.
Philipsburg ....Marble.
St-Armand East ....Chalcopyrite, galena, (argentiferous) hematite, marl, sphalerite.
Stanbridge ....Limonite.

MISTASSINI DISTRICT

Mistassini Lake ....Anthraxolite.
Wakonichi Lake ....Jasper, limestone.

MONTCALM

Chertsey ....Ilmenite, infusorial earth, ochre.
Kilkenny ....Marble, asbestos.
Lussier ....Marble.
Lynch ....Ochre.
Rawdon ....Garnet, ilmenite, marble, mineral water, titaniferous magnetite.

MONTMAGNY

Talon ....Asbestos.

MONTMORENCY

Chateau Richer ....Feldspar, limestone.
Laval Settlement ....Infusorial earth.
River Jean Larose ....Limestone, petroleum.
Orleans Island ....Anthraxolite, glauconite.
Petit Pré ....Mica.
Ste-Anne de Montmorency ......Ochre.

NAPIERVILLE

Napierville ....Peat.

NICOLET

Baie du Febvre ....Mineral water.
Gentilly ....Limonite, ochre.
Roquetaille ....Natural gas.
St-Grégoire ....Shale, natural gas.
Ste-Monique ....Shale.

PONTIAC

Aldfield ....Molybdenite.
Alleyn ....Mica, molybdenite.
Beauchêne ....Garnet.

Bristol	Magnetite, marl.
Bryson	Mica.
Calumet Island	Nickel, feldspar, galena, hematite, limestone, molybdenite, pyrrhotite, sphalerite, tourmaline.
Cawood	Asbestos, biotite, mica, muscovite.
Clapham	Molybdenite.
Clarendon	Mica, molybdenite, muscovite, pyrite.
Coulonge River	Molybdenite.
Huddersfield	Fluorite, mica, molybdenite.
Kakabonga lake	Graphite.
Leslie	Ochre.
Litchfield	Apatite, dolomite, limestone, magnetite, marble, mica molybdenite, pyrrhotite, titaniferous magnetite.
Mansfield	Apatite, mica, ochre.
Onslow	Barite, fluorite, mica, molybdenite, ochre.
Pipestone River	Chalcopyrite.
Pontefract	Apatite, limestone, marble.
Portage du Fort	Dolomite.
Thorne	Apatite, mica, molybdenite.
Waltham	Apatite, feldspar, graphite, mica, molybdenite.

PORTNEUF

Bois	Granite.
Bourg Louis Seigniory	Ochre.
Cap Santé	Shale.
Chavigny	Magnetite, quartzite, sulphides.
Colbert	Infusorial earth, granite.
D'Auteuil Fief	Peat.
Gosford	Infusorial earth.
Lac des Sables	Limonite.
Montauban	Galena, (argentiferous), quartzite, sphalerite.
Pont Rouge	Peat.
Portneuf	Shale.
Price Seigniory	Galena, marble.
St-Basil	Limonite.
St-Marc des Carrières	Limestone.
Valcartier	Peat.

QUEBEC

Québec	Anthraxolite.
Beauport	Limestone, marl, shale.
Montmorency	Shale.
Neilsonville	Sandstone.
Sillery	Anthraxolite, shale.
Stoneham	Infusorial earth.

RICHELIEU

St-Ours Parish	Mineral water.
St-Roch	Natural gas.

RICHMOND

Brompton .... Chalcopyrite, chromite, slate.
Brompton Gore .... Asbestos, slate.
Cleveland .... Asbestos, azurite, bornite, chalcocite, chalcopyrite, chrysocolla, chromite, hematite, malachite, melaconite, manganese, native copper, slate.
Danville .... Granite, slate.
Kingsey .... Marble.
Melbourne .... Adularia, chromite, chalcopyrite, serpentine, shale, slate.
Shipton .... Asbestos, chalcocite, gold alluvial, slate.
Stoke .... Chalcopyrite, gold (alluvial), ochre, pyrite.

RIMOUSKI

Duquesne-Macpès .... Peat.
Neigette .... Marl.
Nicholas Rioux Seigniory ...... Barite, galena.
Rimouski Seigniory .... Peat.

ROUVILLE

Canrobert .... Peat.

SAGUENAY

Arnaud .... Iron sands, titaniferous magnetite.
Bergeronnes .... Feldspar, mica, muscovite, peat.
Betsiamites .... Iron sands, ochre.
Cary .... Molybdenite.
Cook .... Pyrrhotite.
De Monts .... Ochre.
Duval .... Iron sands.
Fitzpatrick .... Limestone.
Iberville .... Ochre.
Ile à la Chasse .... Iceland spar.
Kegashka .... Iron sands.
Lafleche .... Feldspar, garnet sand, iron sands.
La Gorgendière .... Molybdenite.
Laval .... Iron sands.
Les Escoumains .... Granite, ochre.
Letellier .... Iron sands, titaniferous magnetite.
Little Matonipi Lake .... Magnetite.
Little Mecatina River .... Chalcopyrite.
Manicouagan .... Mineral water, ochre.
Manicouagan Lake .... Garnet.
Mingan Islands .... Lithographic limestone.
Moisie .... Iron sands, peat.
Mouchalagan Lake .... Garnet.
Musquarra River .... Biotite.
Natashquan .... Iron sands.
Pointe des Monts .... Feldspar.
Quatachou Bay .... Feldspar.

Romaine River ....Labradorite.
Saguenay ....Mica, muscovite.
St-Augustin ....Iron sands.
St-Vincent ....Molybdenite.
Seven Islands ....Ilmenite, magnetite.
Tadoussac ....Feldspar, mica, muscovite.
Terre Ferme de Mingan ....Beryl, chalcopyrite, fluorite, granite, ilmenite, iron sands, jasper, kaolin, labradorite, limestone, marble, mica, microcline, molybdenite, moonstone, muscovite, ochre, peat, pyrite, sandstone, titaniferous magnetite.

ST. HYACINTHE

La Providence ....Mineral water.
St-Amable ....Natural gas.
St-André ....Natural gas.
St-Hyacinthe ....Mineral water.
St-Jude ....Natural gas.

ST. MAURICE

Belleau ....Graphite.
Caxton ....Mineral water.
Pointe du Lac Seigniory ....Ochre.
St-Barnabé nord ....Natural gas.
St-Etienne ....Limonite.
St-Etienne Fief ....Peat.
St-Sévère ....Mineral water.
Shawinigan ....Graphite, infusorial earth, titaniferous magnetite.
Troyes ....Magnetite.

SHEFFORD

Ely ....Chalcopyrite.
Granby ....Slate.
Roxton ....Chalcopyrite.
Shefford ....Chalcopyrite, granite, quartzite.
Stukely ....Chalcopyrite, manganese, marble, spinel.

SHERBROOKE

Ascot ....Arsenopyrite, chalcopyrite, galena, gold (alluvial) hematite, jasper, ochre, pyrite, tetrahedrite.
Orford ....Chalcopyrite, chromite, gold alluvial, granite, magnetite, marble, nickel, ouwarovite, serpentine, slate.
Sherbrooke ....Limestone.

STANHOPE

Barnston ....Granite.

STANSTEAD

Hatley	**Chalcopyrite. gold alluvial, talc.**
Stanstead	**Granite, limonite, manganese, marble, marl, ochre.**

TEMISCAMINGUE

Beauneville	**Mica.**
Boischatel	**Auriferous pyrite, chalcopyrite, free gold, fuschite, galena, pyrrhotite, tellurides.**
Dasserat	**Free gold, fluorite, galena, pyrite.**
Dufay	**Bornite, chalcopyrite.**
Duhamel	**Asbestos, cobalt bloom, galena (argentiferous).**
Fabre	**Chalcopyrite, cobalt bloom, galena, hematite, niccolite, smaltite.**
Gaboury	**Asbestos, gold.**
Guérin	**Molybdenite**
Guigues	**Galena, limestone, sandstone.**
Joannès	**Arsenopyrite, chalcopyrite, free gold, pyrite.**
Kinojévis River	**Arsenopyrite.**
Rouyn	**Arsenopyrite, zinc-blende, chalcopyrite, free gold, pyrite (auriferous).**

TEMISCOUATA

Botts	**Slate.**
Cacouna	**Manganese.**
Fraserville	**Sandstone.**
Glendyne	**Slate.**
Le Parc Seigniory	**Peat.**
L'Isle Verte Seigniory	**Mineral water.**
Rivière du Loup Seigniory	**Granite, peat.**
Terrebois Seigniory	**Peat.**
Whitworth	**Granite, peat.**

TERREBONNE

Beresford	**Ilmenite, rutile.**
De Salaberry	**Marble.**
Grandison	**Garnet, magnetite.**
Mille Islands Seigniory	**Magnetite, marble, peat, titaniferous magnetite.**
Morin	**Magnetite.**
St-Jérôme	**Garnet, granite, limestone.**
Ste-Thérèse	**Peat.**
Wexford	**Ilmenite.**

TWO MOUNTAINS

Grande Frenière	**Kaolin.**
St-Benoit	**Mineral water.**
St-Canut, Parish	**Granite, silica, sandstone.**
St-Eustache	**Mineral water.**
St-Scholastique	**Sandstone.**

UNGAVA

East Main River ....Muscovite, pyrite.
Hudson Bay ....Agate, galena (argentiferous).
James Bay ....Lignite.
Koksoak River ....Jasper, magnetite, pyrite, pyrrhotite.
Lake Winokapan ....Muscovite.
Little Whale River ....Galena (argentiferous).
Long Island ....Anthraxolite, pyrite.
Menikek Lake ....Anthraxolite, magnetite, pyrite, pyrrhotite.
Michikaman ....Labradorite.
Nastapoka Islands ....Manganese.
Richmond Gulf ....Galena, sphalerite.
Summit Lake ....Garnet.
Ungava Bay ....Graphite, mica.
Wabamisk River ....Pyrite.
Whitney Bay ....Garnet.

VAUDREUIL

Rigaud Mountain ....Diorite.
St-Michel Parish ....Silica, sandstone.
Vaudreuil ....Limonite, marl, ochre.

VERCHERES

Contrecœur Parish ....Natural gas.
Grande Côte ....Natural gas.
Varennes ....Mineral water.

WOLFE

Dudswell ....Dolomite, lode gold, gold (alluvial), limestone, marble.
Garthby ....Asbestos, chromite, copper, pyrite, talc, slate.
Ham ....Asbestos, bornite, chalcopyrite.
Ham South ....Antimony, chromite, magnetite, talc, serpentine.
Lac Weedon ....Limonite.
Weedon ....Chalcopyrite, pyrite.
Stratford ....Pyrite, pyrrhotite, chalcopyrite.
Wolfestown ....Asbestos, chromite, talc.
Wotton ....Asbestos.

YAMASKA

St-François du Lac ....Mineral water.
St-Joseph de Courval ....Shale.
Yamaska Parish ....Natural gas.

ACQUISITION OF MININGS LANDS IN THE PROVINCE OF QUEBEC

The mining laws in force in the province of Quebec, are very liberal, and are favourable to the prospector. The provisions of the law give security of title and they are not onerous, either in money or in assessment work. Moreover, it may be mentioned that in the province of Quebec mineral lands on which the mining rights belong to the Crown, which means in the vicinity of 90% of the total area of the province, may be taken up, held or acquired by British subjects or by aliens alike on the same terms, without distinction of any sort between them

The procedure to acquire mining lands is as follows :

The intending prospector gets from the Department of Colonization, Mines and Fisheries a " Miner's Certificate ", cost $10, which expires on December 31st following.

This certificate entitles the holder to stake out, anywhere in the Province, mining claims on lands on which the minerals belong to the Crown, to a maximum area of 200 acres, in parcels of 40 acres each in unsurveyed lands. and in half-lots in subdivided townships. The surveyed lots are, as a rule, 100 acres each.

After the staking, that is driving a stake at each corner of the ground with inscriptions of his name, date of pegging, and number of his certificate, the prospector must register his claim without delay. This registration is done at the nearest mining recorder's office, of which there is one in Temiscamingue county, another in Abitibi, and the central office at Quebec. There is no fee for this registration.

In the course of the following six months (December, January, February, March and April being excluded, owing to the climatic conditions) the claim holder must do twenty-five days work on each claim of 40 acres.

At the end of the six months, he may apply for the concession ; that is, he may apply to buy the land outright in fee simple. Or if not yet sufficiently assured of the value of his claim to invest the price of the concession, he may apply for a working license (mining license) good for one year from the date of expiration of the claim.

If he applies for the concession in fee simple, he must have his claim surveyed by a Provincial Land Surveyor, and pay the purchase price $5. per acre for superior minerals (metallic and non metallic as enumerated in article 3 of the mining law), or $3 for inferior minerals. Then before the expiration of the two years following the application, he must spend $1000., for each 100 acres, in " bona fide " actual mining work. He is then entitled to his patent. If these conditons are not fulfilled within the specified time, the minister has the discretionary power to cancel the sale or concession.

All mining lands thus conceded are subject to an acreage tax of 10c per acre yearly and to a duty on annual profits.

If the holder of the claim chooses to apply for a working license, good for one year, he pays 50 cts an acre per year, and a registration fee of $10., and he has to do 25 days work on each claim of forty acres during the year in force. At any time, the holder of a working license (called mining license in the Quebec law) may apply for the concession on the terms enumerated above.

The Quebec Bureau of Mines will gladly give all the information available in connection with the mines, mineral resources and the mining regulations of the province of Quebec on request addressed to :

The Hon. the Minister of Colonization,
Mines and Fisheries,
Quebec, Canada.

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