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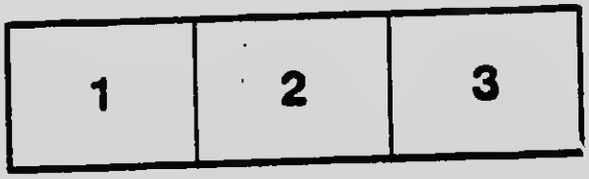

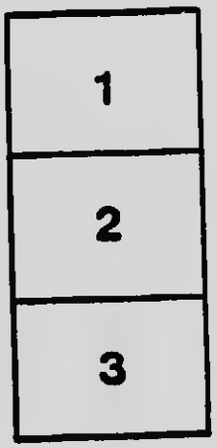

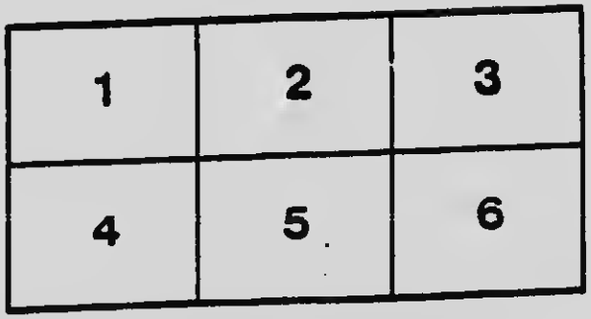

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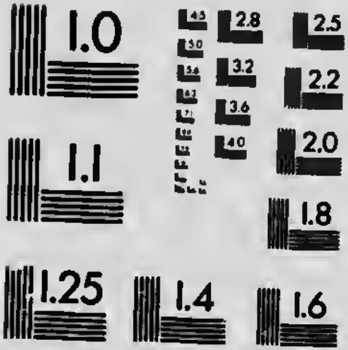

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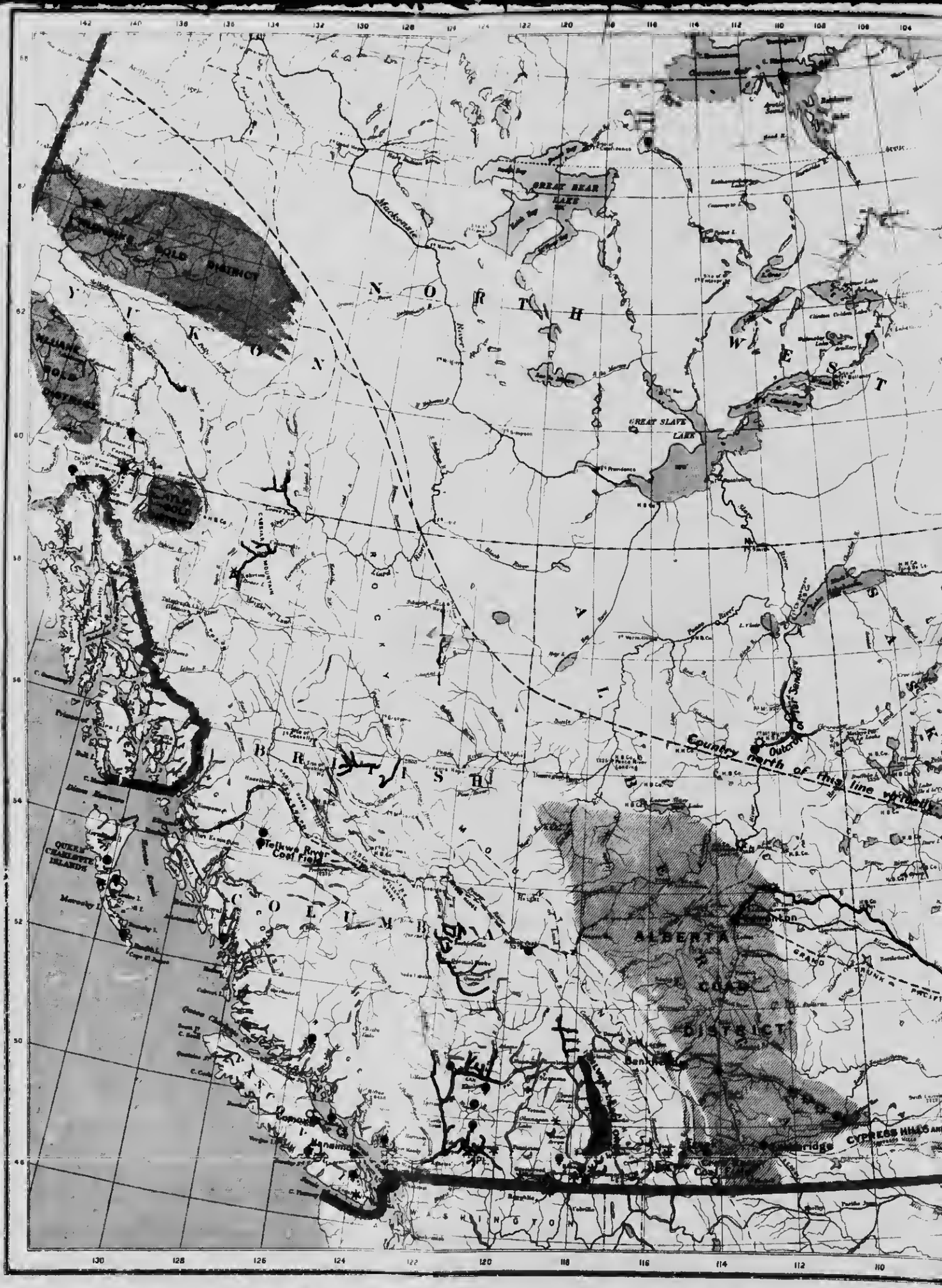
MINERAL RESOURCES OF CANADA

To Celebrate

The Visit of the British and Continental Mining Engineers and Metallurgists to Canada in the Summer of 1908

PUBLISHED BY
THE CANADIAN MINING JOURNAL
CONFEDERATION LIFE BUILDING,
TORONTO, ONT.


YUKON
KLONDIKE GOLD DISTRICT
WILLIAMS GOLD DISTRICT
CARIBOO GOLD DISTRICT
NORTH WEST
GREAT BEAR LAKE
GREAT SLAVE LAKE
Mackenzie River
BRITISH COLUMBIA
Country north of this line
Telkwa River Coal Field
QUEEN CHARLOTTE ISLANDS
ALBERTA
COAL DISTRICT
GRAND TRUNK PACIFIC
CYPRESS HILLS
WASHINGTON


HUDSON BAY
Southampton I.
James Bay
NORTHWEST TERRITORIES
MANITOBA
ONTARIO
Country north of this line
LIGNITE
Source Coal Field
LAKE SUPERIOR
THUNDER BAY MINING DIST.
ATIKOKAN IRONDOME
HUNTER I. IRON DIST.
CYPRESS HILLS AND WOOD MOUNTAIN COAL DISTRICTS


HUDSON BAY
NORTHWEST TERRITORIES
MANITOBA
ONTARIO
Southampton I.
James Bay
LIGNITE
Country south of this line virtually uncharted
Line of principal rivers
Souris Coal Field
LAKE SUPERIOR

Compiled under the direction of
James White, F.R.G.S., Geographer
Dep't of Interior.

INTRODUCTION

This little volume is designed to celebrate the summer excursion of the Canadian Mining Institute.

The official guests of the Institute represent the following British and Continental societies:—

The Institution of Mining and Metallurgy.
The Iron and Steel Institute.
The Mining Institute of Scotland.
The South Wales Institute of Engineers.
The Manchester Geological and Mining Society.
L'Association des Eleves des Ecoles Speciales, Belgium.
French and German official representatives have also been invited.

In addition to these guests there will be many British, Continental, Canadian, and American mining men, taking part unofficially in the excursion. Several of the larger mining concerns and a few technical periodicals are sending representatives.

The excursion was organized for the purpose of affording an opportunity to distinguished mining engineers, geologists and others, of gaining a comprehensive idea of the extent and variety of the developed and undeveloped mineral resources of Canada. In magnitude, comprehensiveness and systematic completeness the approaching excursion eclipses anything of the sort attempted in the past.

Visiting first the coal mines and iron smelters of Nova Scotia, under the auspices of the Mining Society of Nova Scotia, the party will continue through the mica, asbestos, and chromic iron regions of Quebec; they will see the Canadian National Exhibition in Toronto; they will touch at Cobalt, at the Sudbury Copper Mines, and at the iron mines of Western Ontario.

The excursionists will then proceed west to Alberta, stopping at several coal mines in that Province ,and at the Crow's Nest Pass collieries at Fernie, B.C. Then the metalliferous mining districts and the smelters of Southern British Columbia will be inspected. The western limit of the journey is to be Victoria. On the return trip a short stay will be made at Banff, at the Canadian Pacific Railway's Hotel.

Thus a select, distinguished, and influential body of mining men will be given an adequate conception of the mineral wealth of our vast Dominion.

In Great Britain and on the Continent much injury has been done the Canadian mining industry by the performances of irresponsible promoters and pseudo-mining engineers. Moreover, false reports, either grossly exaggerating the richness of certain mining districts, or damning the whole mining industry of Canada, have lowered the dignity of that industry in the eyes of just such persons as are now being given an opportunity of judging the country's mineral resources for themselves.

It is, therefore, certain that the excursion will advertise Canada's mines and minerals, in the healthiest and most profitable manner possible.

In compiling this booklet there were two objects in view. It is offered, first, as a souvenir of the excursion. In the second place, it aims at presenting in readable form a very brief and, necessarily, very imperfect and incomplete resume of Canada's mineral resources.

The coloured reproductions of certain important minerals are accompanied by a section taking up the nature, modes of occurrence, and commercial value of these and other Canadian minerals.

The small size of the volume rendered it absolutely imperative to omit detailed descriptions of the larger Canadian mines and metallurgical establishments. Thus the Copper Cliff smelters, the Dominion Iron and Steel blast furnaces, and the copper smelters of Southern British Columbia receive mere mention.

On the other hand, it has been the aim of the writer to lay stress upon those districts and industries that are partly or wholly undeveloped, and that require, and would repay, closer attention.

For manifold faults and unavoidable omissions no apology is offered. Not only was space a serious consideration, but the time of preparation was far too short. But years of labour might produce faulty results. This volume should be considered a qualitative, rather than a quantitative, assay.

Thanks are due Mr. J. Obalski, Superintendent of Mines for Quebec, and Mr. T. W. Gibson, Deputy Minister of Mines for Ontario, for specific assistance in gathering information concerning their respective Provinces.

Through the kindness of the Federal Government we are able to include their excellent resource map of the Dominion.

Toronto, Ont., July, 1908.

The Route which the visiting Engineers will take on their trip through Canada with dates of arrival at and departure from the various centres are marked in red

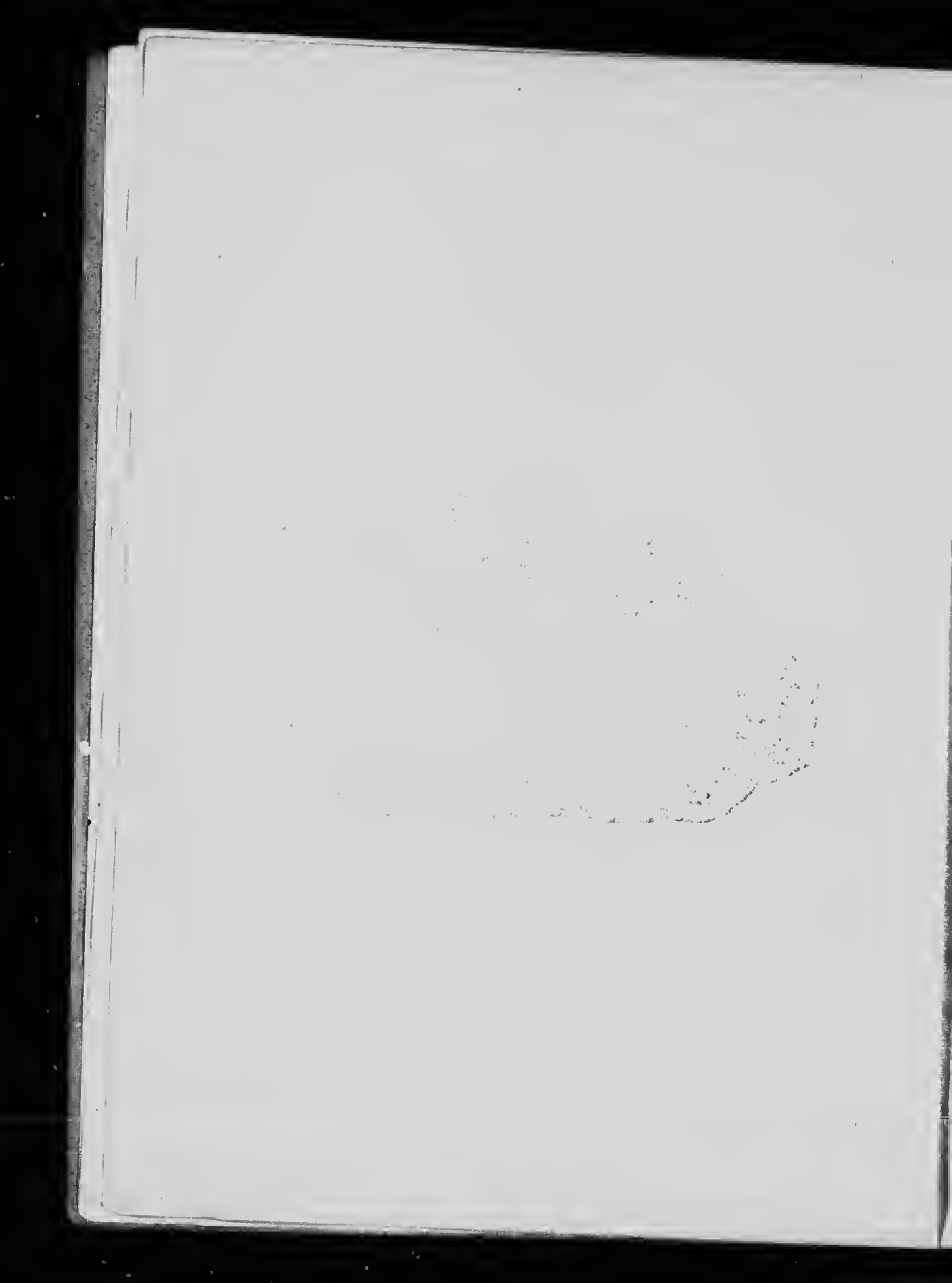
ALBERTITE

From Albert County, New Brunswick.

AMAZONITE
From Nipissing District, Ontario.

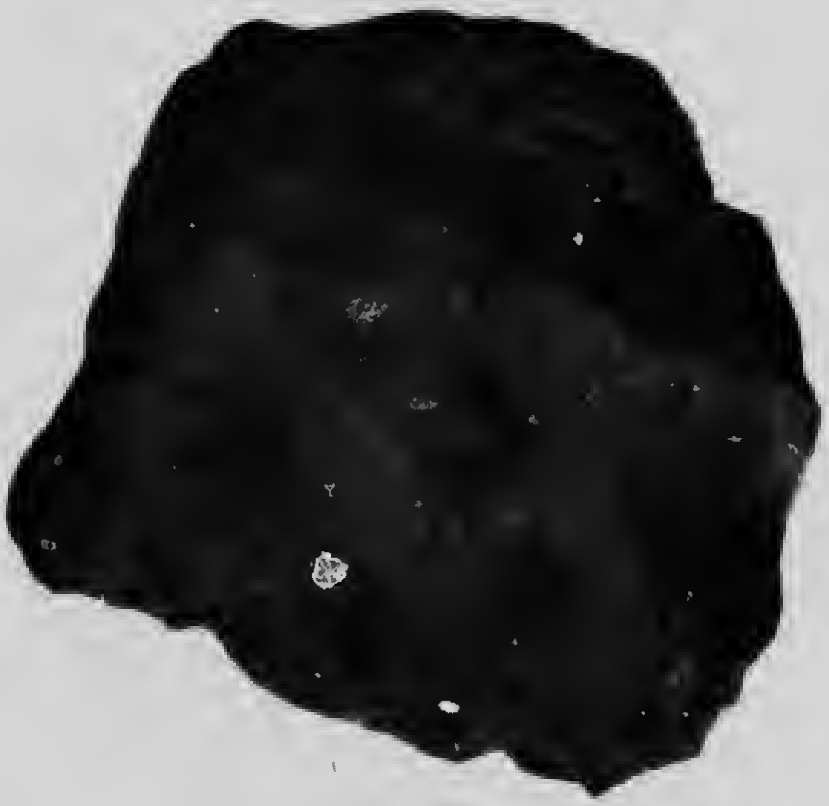
GREEN APATITE

From Templeton, Ottawa County, Quebec.

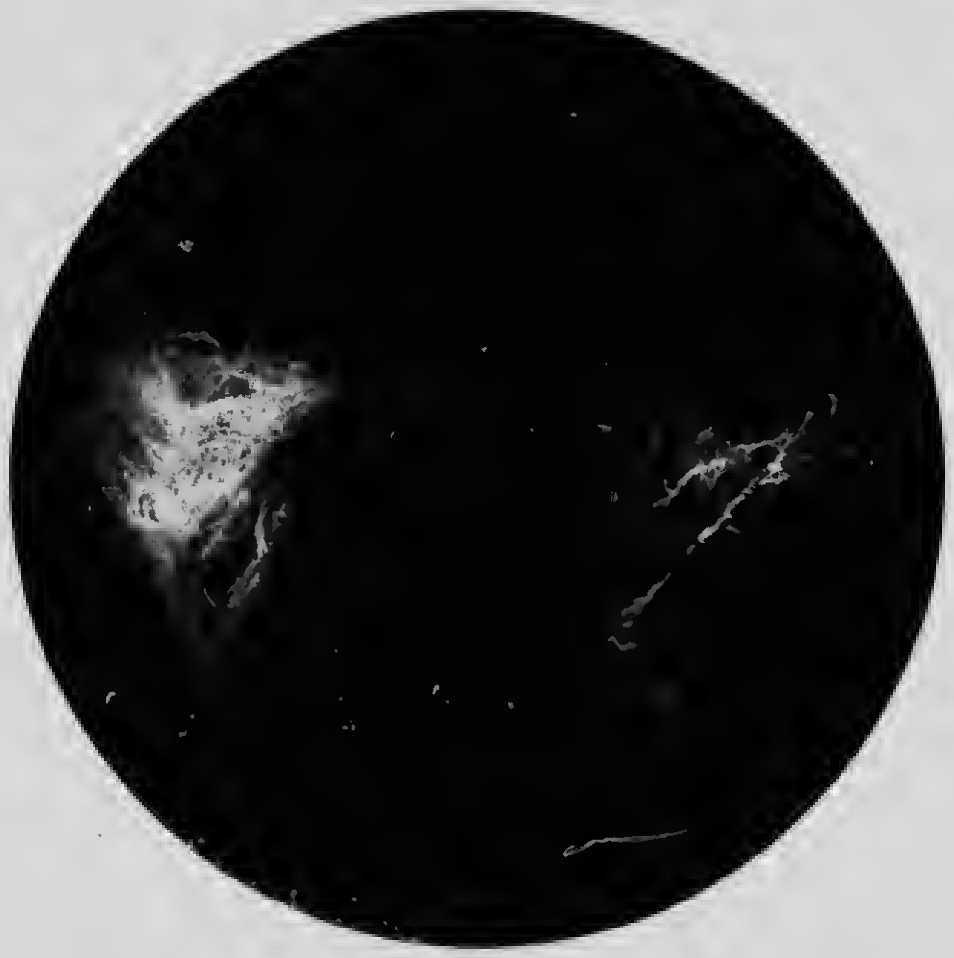


RED APATITE

From Lanark County, Ontario.



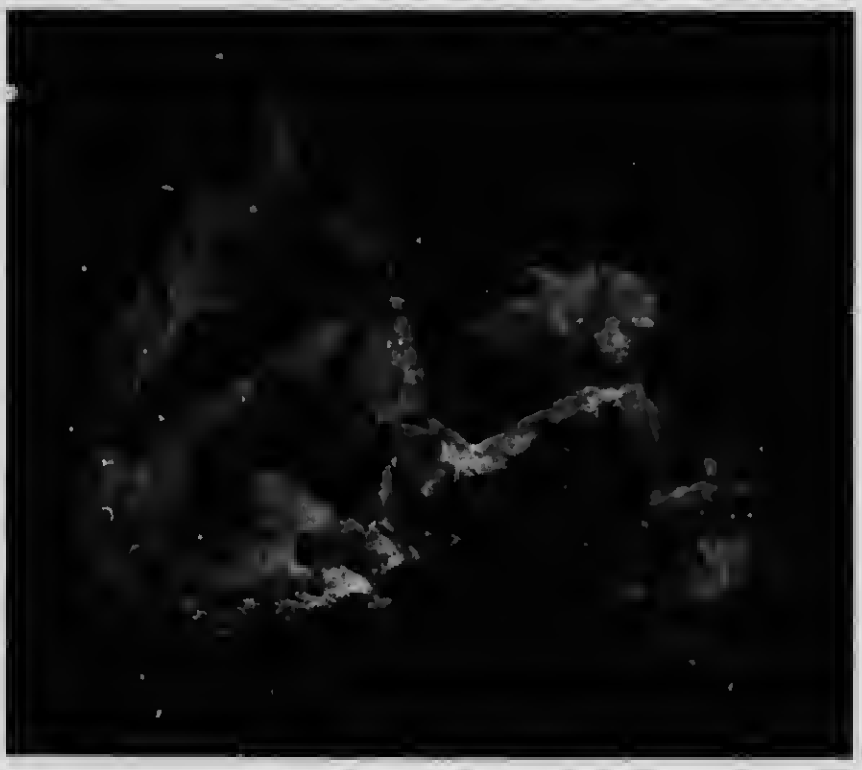
MISPICKEL
From Hastings County, Ontario.



ASBESTOS

From Thetford Quebec

CRYSTALS OF NATIVE BISMUTH ON SMALTITE AND NATIVE SILVER
From the Foster Mine, Cobalt, Ontario.



CELESTITE (Strontium Sulphate)
From Essex County, Ontario.

CHROMITE

From Colraine, Megantic County, Quebec.

CORUNDUM

From Craigmont, Hastings County, Ontario.

COPPER ORE (Chalcopyrite)
From the Boundary District, British Columbia.

COPPER

From Lake Superior District, Western Ontario. On the left, weathered copper-bearing amygdaloidal trap; on the right, metallic copper.

COPPER SPECIMENS

From Western Nova Scotia.

Upper—Malachite (green) and Azurite (blue). Lower—Native Copper.

COBALT NICKEL-SILVER ORE

From Cobalt, Ont.: showing Cobalt Bloom (pink), Nickel Bloom (green) and Native Silver.

FELDSPAR

From Templeton, Ottawa County, Quebec.

FLUORSPAR

From Madoc, Hastings County, Ontario.

BITUMINOUS COAL
From Springhill, Nova Scotia.

GOLD ORE

From Goldboro, Guysborough County, Nova Scotia. On the left, rich gold-bearing quartz heavily impregnated with mispickel: on the right, milky quartz, with visible gold.

GRAPHITE
From Buckingham, Quebec.

SELENITE (Variety of Gypsum)
From Elmsdale, Nova Scotia.

IRON ORE

From Colchester County, Nova Scotia. Botryoidal Limonite

IRON ORE MAGNETITE

From Moose Mountain, Western Ontario.

SILVER-BEARING GALENA
From the Boundary District, British Columbia.

MANGANESE ORE (Manganite)
From Bridgeville, Nova Scotia.

MICA

From Sydenham, Frontenac County, Ontario.

MOLYBDENITE
From Quebec.

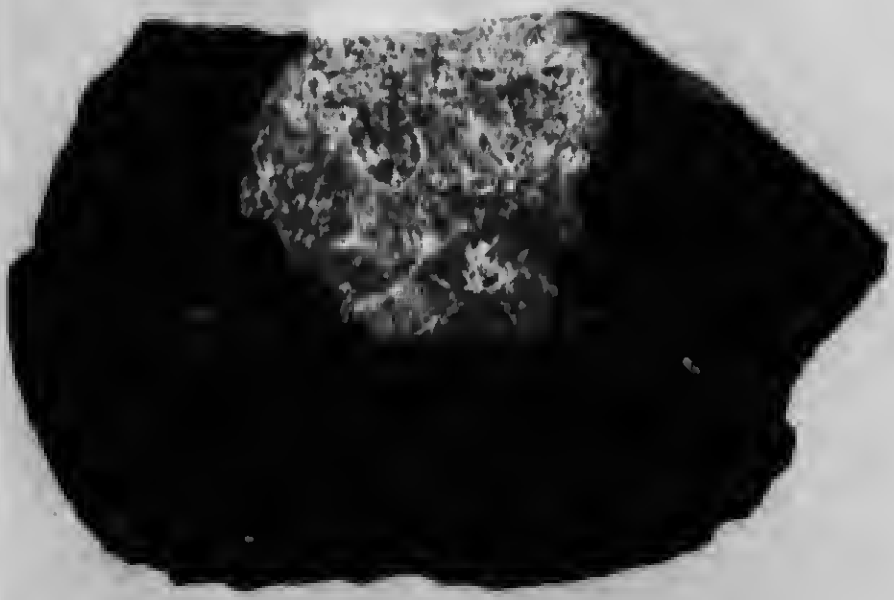
COPPER (Chalcopyrite) and NICKEL (Pyrrhotite) ORE
From Sudbury, Ontario.

IRON PYRITE
From Quebec.

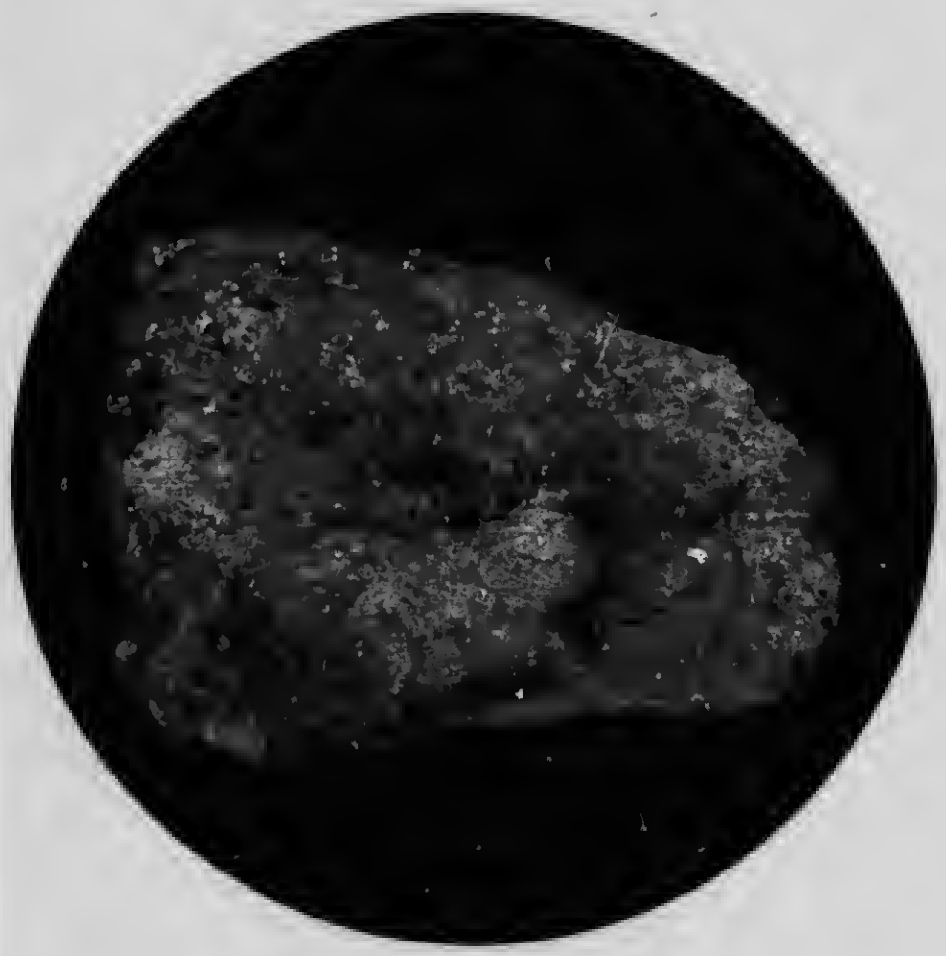
QUARTZ CRYSTAL

From New Ross, Nova Scotia. This crystal comes from a pegmatite dike in which Tin-Oxide (Cassiterite) has been found.

RUTILE (Titanium Oxide)
From Templeton, Wright County, Quebec.



SODALITE
From Hastings County, Ontario.



TALC
From Madoc, Hastings County, Ontario.

Economic Minerals of Canada.

The economic minerals of Canada are numerous and well distributed. The following list is intended merely to indicate their variety and known extent. Every year brings its discoveries either of minerals not heretofore found, or of new deposits of minerals that are known to occur in other places. Vast northern areas of Quebec, Ontario, British Columbia, and Alberta are yet unprospected. Nova Scotia is still one of the most promising fields. In New Brunswick, within the past year, a magnificent body of merchantable iron ore, whose existence was long unsuspected, has been exploited.

This inventory of Canada's mineral resources is incomplete and inadequate. But it will serve the purpose for which it has been compiled, i.e., to provide a convenient glossary for the reader. To prevent confusion the minerals are given in alphabetical order.

ALBERTITE.

Albertite is valuable for its heavy yield of crude oil. One ton gives 100 gallons of oil, or 14,500 cubic feet of excellent illuminating gas.

It differs from ordinary asphaltum in being only partly soluble in oil of turpentine, and from true coal in being homogeneous and in containing no trace of vegetable tissue. Its mode of occurrence in veins, and not in beds, also differentiates it from coal. It is softer and lighter than bituminous coal. Its peculiarly brilliant lustre and its jet-black color are distinctive. It possesses no structure and has a broad conchoidal fracture.

Albertite is not mined now. It was discovered in Albert County, New Brunswick, in 1850, where it was mined to a depth of 1,500 feet, gradually thinning out to the deep. About 200,000 tons were produced and the price obtained ranged from $15.00 to $20.00 per ton.

The New Brunswick occurrence is the only one known.

ANTIMONY.

Antimony is chiefly used for alloying with other metals to impart hardness and lustre. It enters into type metal and pewter. Combined with aluminum and other metals it makes special alloys. Antifriction metals contain antimony.

Stibnite, antimony sulphide ($Sb_2 S_3$) colour and streak lead-gray, metallic lustre, same hardness as gypsum, usual crystallization, columnar, also found granular and massive, cleavage perfect.

Stibnite ore containing 50 per cent. antimony sells for $50 to $60 per ton in the London market. It should be free from such impurities as arsenic, lead and copper.

Nova Scotia.—Stibnite occurs at West Gore, Hants County, in a vein six feet wide. The vein cuts grey talcose slates. About twenty inches of the vein is pay-ore, consisting of stibnite, kermesite (red antimony sulph-oxide), valentinite (white antimony oxide), and galena, in a gangue of calcite. The ore carries from $15 to $40 in gold per ton, and from 17.5 per cent. to 45 per cent. antimony.

New Brunswick.—Stibnite is found near the St. John River, Prince William, York County. It occurs in veins of milky quartz, in metamorphosed slates and quartzites. At one time the veins were worked; they are now idle, although in quality and quantity the ore is satisfactory.

Quebec.—At South Ham, Wolfe County, stibuite is found in commercial quantities in veins as wide as 16 inches, associated with a gangue of quartz and dolomite. The principal vein intersects magnesian slates and schists.

APATITE.

Apatite (phosphate rock) is used exclusively in the manufacture of artificial fertilizers and chemicals containing phosphoric acid.

Apatite is calcium phosphate. Its lustre is vitreous, its streak white. It is brittle and fairly hard. Color usually shades of green or blue, sometimes yellow, gray, red, or brown. It is never of a bright color. May be either transparent or opaque, has an imperfectly columnar structure, also found massive or granular. When crystallized it is characterized by its hexagonal form.

Apatite contains small percentages of either or both chlorine and fluorine. The proportion of phosphorus pentoxide in the pure mineral is 40.92 per cent. and 42.26 per cent., for chlor-apatite and fluor-apatite respectively.

Apatite occurs most commonly in altered crystalline rocks, especially in granular limestone. It is found in many localities in Ontario and Quebec. Ottawa County, Quebec, produced thousands of tons before competition in the United States killed the industry. Canadian apatite is of excellent quality. It brings about $10.00 per ton on the market.

ARSENIC.

Arsenic, in the form of arsenious oxide or white arsenic, ($As_2 O_3$), is in demand principally for the manufacture of Paris green. It is used also as a base for pigments and, to a limited extent, in medicine as a tonic. It is employed as an insecticide and as a conveyor or fixer of aniline colors in calico printing. Arsenic is one of the most widely diffused elements.

Arsenical Pyrites or Mispickel.—(Fe As S, or iron 34.4 per cent., arsenic 46, sulphur 19.6), color silver-white to steel-gray, streak dark grayish-black, fracture uneven, metallic lustre, hard and of specific gravity 6 to 6.4, usually in distinct crystals, but often granular and compact. Found principally in cryatalline rocks. Usually associated with ores of gold, silver, lead, zinc and tin.

Mispickel ore, to be marketable, must contain from 25 per cent. to 30 per cent. of arsenic. It then brings 30 cents to 50 cents per unit, f.o.b. place of shipment, the value of the ore fluctuating with the market quotations for white arsenic.

Large, workable deposits of mispickel have been found in Ontario, Quebec, and Nova Scotia. In the Cheticamp District, Inverness County, Cape Breton, mispickel occurs in chlorite and serecite schists. It contains gold to the value of from $4.00 to $97.00 per ton. Nearly all the mispickel of Quebec and Ontario is gold-bearing. The usual gold contents range from $3.00 to $18.00 per ton. At Deloro, Hastings County, Ontario, gold-bearing mispickel has been worked for years and the arsenic has been saved and marketed. From the silver-nickel-cobalt ores of the Cobalt districts, arsenic is now being saved by Canadian smelters as a by-product.

ASBESTOS.

The fibrous character of asbestos and the fact that it is an excellent non-conductor of heat and electricity give it commercial value. Amphibole asbestos, or serpentine asbestos, which is weaker and less valuable than chrysotile, is manufactured into boiler lagging, steam-pipe covering, and miscellaneous insulating material. The best chrysotile fibre is spun into thread, yarn, and rope, and woven into fireproof cloth.

New uses are being constantly found for asbestos. It is extensively used for plastering and for making fireproof lumber and as an envelope for electrical conductors.

True asbestos is actinolite or tremolite, members of the amphibole group. Both of these minerals are magnesia-lime silicates. Actinolite contains up to 6 per cent. iron oxide. Tremolite is dark grey to white in color, fibrous or columnar in structure. Actinolite is bright green and grayish green in color.

Chrysotile, or serpentine asbestos, is the standard asbestos of the trade. It is found in aggregates of easily separable, flexible, silky fibres. In color it ranges from greenish white to green and yellow. Its lustre is silky metallic. In composition, chrysotile is a hydrated magnesian silicate.

The Province of Quebec furnishes 85 per cent. of the world's supply. The mineral is found in an area of serpentine rock, which is surrounded by Cambrian slates. Small veins, or fibres, one to four inches wide, traverse the rock in all directions.

The demand for asbestos is larger than the supply. Varying with the grade the price ranges widely. As high as $300 is paid for No. 1 crude per short ton. From that figure a drop to $17.00 is marked in the price of amphibole asbestos.

BARYTES.

Barytes, or heavy spar, is principally used as a white pigment. It also has a place in the manufacture of paper, cloth, rubber, barium salts and as an adulterant. It must be free from calcium carbonate, silica, iron oxide or manganese oxide. Commercial grades carry from 95 to 98 per cent. barium sulphate.

Barytes (barite, heavy-spar) is barium sulphate ($BaSO_4$). It is made up of 65.7 per cent. barium oxide and 34.3 per cent. sulphur trioxide. Its hardness is about the same as limestone, but it is much heavier. This easily distinguishes the mineral. It does not effervesce with acids. It is a white mineral, sometimes displaying shades of yellow, brown, blue, or red. It may be transparent or opaque. In structure it may be coarsely laminated, fibrous

granular, or massive. A common form is an aggregate of curved plates. Occasionally bands of different colors are shown. Often it gives off a fetid odor when rubbed.

Deposits of this mineral have been found all over Canada. It has been worked principally in Nova Scotia and Ontario, where large bodies occur, especially in Nova Scotia.

Barytes brings about $3.00 per ton, although often quoted at a much higher figure. Nearly the whole Canadian production (about 4,000 tons) comes from Lake Ainslie, Inverness County, Nova Scotia, and is exported crude to the United States. The industry is capable of great expansion, especially in the two provinces named above.

CELESTITE.

From celestite is produced strontium nitrate, an essential ingredient of fireworks, colored fire, etc.

Celestite is the sulphate of strontium ($Sr\ S\ O_4$). It is a transparent or translucent mineral, white to faint blue in color, easily fusible, brittle, and of pearly and vitreous lustre.

It is usually associated with limestone or sandstone. Large veins are known in Quebec, especially in Bagot Township, Chicoutimi County, Quebec. Also near Kingston, Ontario, celestite is found in quantity. But the mineral is of wide distribution.

CHROMITE.

Chromite is in demand as a source of chromium, useful for alloying with steel. The growing use of the chromium salts in the tanning industry, and of chrome brick for refractory purposes, call for larger amounts than the first-mentioned use.

Chromite resembles magnetite in appearance and physical qualities. Its streak is brown, color iron-black and brownish-black. It is brittle and has an uneven fracture. It commonly occurs in massive form. Lustre submetallic.

In chemical composition chromite is a combination of iron and chromium oxides ($Fe\ O\ Cr_2\ O_3$). Magnesia is usually present in varying amounts from 6 to 24 per cent.

The chrome deposits of Quebec all lie in what is known as the serpentine belt. It has been found only in peridotites and allied magnesian rocks, probably of Cambrian age.

Crude ore and concentrates, grading from 45 per cent. and upwards of chromic sesquioxide, bring from $9 to $13 per ton. Quebec produces about 9,000 tons per annum. The United States annual production amounts to less than 200 tons.

COBALT.

The pentlandite of Sudbury contains nearly one per cent. of cobalt. Not more than 20 to 30 tons per annum of the metal are contained in the matter produced at the smelters of the district.

The Cobalt district ores are much more prolific sources of the metal.

The chief cobalt-bearing minerals are:

Smaltite, or diarsenide of cobalt ($Co\ As_2$), a tin-white mineral, weathering iridescent, and usually containing varying amounts of cobalt, nickel and iron. The average cobalt content is about 9 per cent., although it may run higher. Nickel is rarely absent and sometimes almost replaces the cobalt.

Erythrite, or cobalt bloom ($Co_3\ As_2\ O_8 + 8\ H_2\ O$), is an arseuate of cobalt. It is crimson or peach-red in color, soft and earthy. It is soluble in hydrochloric acid, giving a rose-red solution.

Cobaltite, cobalt sulph-arsenide ($Co\ As\ S$) is a silver-white mineral tinged with red. Streak grayish-black, cubical clearage, commonly granular or compact massive.

Nickel is used largely in nickel plating and in the manufacture of nickel steel, to which it impaets hardness and toughness. It also is used in the United States coinage.

Cobalt, for which there is a limited demand, does not replace nickel. It is used, in the form of cobalt oxide, for coloring purposes. As an alloy for steels it has not as yet been used with marked success. There is, however, much room for investigation.

CORUNDUM.

Corundum is the most important natural abrasive. Its hardness is exceeded only by the diamond. The crushing and preparation of corundum for the market is difficult and costly. Prepared, it sells for from 5 to 10 cents per pound.

Corundum is pure crystalized alumina ($Al_2\ O_3$). It stands as No. 9 in the scale of hardness, next to the diamond. Its specific gravity is about 4. Its color is blue, red, yellow, brown or gray. It is translucent and shows a shell-like fracture. Its crystal habit is well shown in the colored reproduction. It is found in granular or massive state and in large well-defined crystals.

Corundum has been discovered and worked in Ontario, where it occurs in syenite and nepheline-syenite rocks. These rocks form a belt about 80 miles in length, running irregularly from Peterborough County through Haliburton, Hastings and Renfrew counties. At Craigmont, in Renfrew County, the plant of the Canada Corundum Company produces nearly the whole amount reported for Canada.

COPPER.

The copper-bearing minerals of Canada are too numerous to describe in detail. The principal minerals only can be dealt with here. The sulphide ores are the most important. Next in commercial value are native copper, the carbonates azurite and malachite, the copper oxides melaconite and cuprite, the copper silicate chrysocolla, and the arsenical and chloride ores of copper.

Chalcocite, a sulphide of copper ($Cu_2\ S$), carries 79.8 per cent. copper. It is commonly called copper glance or vitreous copper. Its color and streak are blackish lead-gray. On tarnishing it becomes dull green or blue. It crystallizes in the orthorhombic system, but occurs also massive, with granular to impalpable structure. It is about the same hardness as limestone and of high specific gravity (5.5 to 5.8). Lustre, metallic. Soluble in nitric acid.

Chalcocite is the richest ore of copper. More than one-half the world's supply of copper is derived from this mineral.

Chalcopyrite is the most widely disseminated ore of copper. In Canada it is found more frequently and in greater abundance than any other copper-bearing mineral. Chalcopyrite is a sulphide of copper and iron ($Cu\ Fe\ S_2$), in which copper occupies 34.6 per cent., iron 30.5 per cent., sulphur 34.9 per cent.

Brass-yellow in color when fresh, it tarnishes on weathering, often becoming iridescent. Its streak is greenish-black, its lustre metallic. Chalcopyrite is considerably softer than ordinary iron pyrites. It is soluble in nitric acid, forming a green solution in which sulphur appears undissolved.

Bornite, a copper and iron sulphide ($Cu_3\ Fe\ S_3$), contains 55.5 per cent copper, 16.4 per cent. iron, 28.1 per cent. sulphur. Its common name is peacock ore. Its color is copper red to bluish-brown. It tarnishes rapidly, developing a brilliant iridescence. Streak, pale-black; lustre, metallic. Is soluble in nitric acid with separation of sulphur.

Bornite is an alteration product from chalcopyrite. It is a most important ore of copper.

Covellite, copper sulphide (Cu S), containing 66.4 per cent. copper, a soft, dark-blue mineral showing a black streak, is the next important ore. Like bornite, it is a secondary product and while found in most sulphide deposits does not as a rule occur in large quantities.

Chalcanthite (blue vitriol or bluestone), a hydrous sulphate of copper ($Cu\ SO_4 + 5H_2\ O$) is the only commercially important mineral of this class. It is soft, sky-blue in color, and occurs mostly in deposits from mine water in copper sulphide mines.

Native Copper (Cu) scarcely needs description. As found in nature it is always impure and slightly lighter than the chemically pure metal. Its usual impurities are silver, arsenic, bismuth, antimony, zinc, and occasionally mercury.

Azurite and Malachite, the two basic carbonates of copper, contain respectively 55.3 per cent. and 57.5 per cent. of that metal. Azurite is azure blue in color, of vitreous lustre and light blue streak. It is found in oxidized zones of copper ore bodies, almost always with malachite. It is, however, by no means as common as malachite.

Malachite is a green or bluish-green mineral of adamantine lustre, green Like azurite, it is soluble in nitric acid.

There are numerous other sulphides and many carbonates, silicates, arsenates, etc. Space will not allow even a list of their names.

Copper is produced in British Columbia from sulphide ores containing more or less gold and silver, in Ontario from copper-nickel (chalcopyrite and pyrrhotite) ores carrying small quantities of metals of the platinum group, and in Quebec from chalcopyrite. Small amounts of copper ore are mined in New Brunswick and Nova Scotia. British Columbia produced 72 per cent. of the 57,381,746 pounds of copper recorded as Canada's output for 1907. Ontario's share was 19 per cent. The remainder is to be credited to Quebec.

Native copper is found in the Lake Superior District of Ontario and in Nova Scotia, principally at Cape d'Or in Cumberland County. These deposits may yet prove to be commercially valuable.

FELDSPAR.

The Feldspars are compounds of alumina ($Al_2 O_3$) and silica ($Si O_2$) with one or more of the bases potash, soda, and lime. They are grouped as potash-soda feldspars and lime-soda feldspars.

The principal members of the potash-soda group are orthoclase and microcline, two minerals of identical chemical composition ($K Al Si_3 O_8$) and very similar in physical properties. Orthoclase is commonly white, gray, or flesh-red in colour, and sometimes green. It is translucent, lustre vitreous. Hardness slightly less than that of quartz. The distinguishing marks of all feldspars are their hardness and their cleavage in two directions at right angles.

If soda replaces potassium the feldspar is called anorthoclase.

The lime-soda feldspars, or plagioclases, range from pure soda feldspar, albite, to pure lime feldspar, anorthite.

Commercial feldspar usually occurs as a constituent of pegmatites, or very coarse granites.

The potash feldspar, orthoclase and microcline, are the most important. They always occur together.

Orthoclase is mined in Ontario. Its principal uses are in the pottery and enamel-brick industries. It brings from $2 to $6 per long ton crude. Ground feldspar of good quality sells for $10 per short ton.

Orthoclase feldspar is mined in Frontenac County, Ontario. Labradorite, a lime-soda feldspar is plentiful in Eastern Canada.

FLUORSPAR.

Fluorspar, or fluorite, calcium fluoride ($Ca F_2$), calcium 51.1 per cent., fluorine 48.9 per cent., is a crystalline mineral, glasslike and slightly bluish, or white and opaque. The color may vary through shades of blue, red and yellow. It is brittle and has a splintery fracture. It is slightly harder than calcite. On heating it becomes phosphorescent. It is usually pure, running 98 to 99 per cent. calcium fluoride. Under 95 per cent. it is scarcely marketable.

The users of fluorspar, in order of importance are smelters and metallurgists, makers of opalescent glass and enamelled-ware and chemical manufacturers. It has also miscellaneous uses. Good grades of the lump mineral bring $7.50 per ton in New York. Ground fluorspar sells for about $12 per ton.

In Quebec and Ontario there are unworked deposits of fluorspar. It is found in many localities as a constituent of veins. Wherever it is found, indeed, it occurs as a veinstone.

FUELS.

Coal, Peat, Petroleum and Natural Gas.—The occurrences of coal are mentioned in another section of this volume. Nova Scotia, British Columbia, and Alberta are the principal producers. In both Saskatchewan and New Brunswick coal is mined, but only on a small scale.

The eastern coals are bituminous only. In the western provinces, bituminous coals, lignites and anthrscites sre worked. Lignite is worked also in the Yukon.

The workable peat areas of Canada have been estimated at 37,000 square miles, distributed over overy provinco, but principally in Ontario (10,450 miles) and Alberta, Saskatchewan and the Territories (25,000 square miles). This estimato is provisional and undoubtedly far too low. Only a few hundred tons are produced in the Dominion. Thia quantity is credited to Ontario.

Nearly the whole of the petroleum produced in Canada comes from the Ontario oilfielda of Lambton, Essex, and Kent, and the Tilbury and Romnoy fields. The petroleum and natural gas of Ontario are tbe bases of large industries. Both commodities have been found in Alhertn. Natural gas is found in Quehec and Nova Scotia, but hardly in important quantities. Notice is given tbese subjects in the provincial sections of this volume.

GOLD.

Gold is produced in Nova Scotia, Ontario, Saskatchowan, British Columbia and the Yukon. For 1907, about 47 per cent. was obtained from placer and hydraulic workings, and 53 from sulphide and quartz ores. The Dominion produetion for the year was $8,264,765. The various modes of occurrenee will 5e indieated on other pages.

GRAPHITE.

Chemically, **graphite** is carhon, carrying a trace of hydrogen. In nature it contains varying percentages of clayey impurities. The only mineral that migbt be mistaken for graphite is molybdenite. Apart from a slight difference in colour and streak, the streak of molybdenite heing black with a greenish tinge and that of graphite being black, simple blowpipe tests will readily distinguish the minerals.

Graphite is extremely soft, greasy to the touch, blue-hlack to steel-gray in colour, and readily separable into thin flakes. It oecurs in crystalline sebists in beds, dikes and veins. It is contended by many that disseminated grapbite is commercially more valuable than vein graphite, on account of greater regularity and persistenee.

Graphite is found in a'l the mining provinces, but is worked only in New Brunswick, Quebec, a id Ontario.

GYPSUM.

Pure **gypsum** is hydrous lime suphate ($Ca\,SO_4 + H_2O$), lime 32.6 per cent., sulphur trioxide 46.5 per cent., and water of combination 20.9 per cent. It is a soft, white mineral. When impure it may be coloured yellow, brown, red or hlack. When crystallized it has a pearly lustre. When massive it is often dull and earthy. Selenite is a crystallized variety of gypsum, transparent and foliated. Alahaster is a fine-grained variety. Satin spar is fibrous gypsum. Anhydrite has the same ehemical composition as gypsum withont the combined water. It is considerahly harder and its cleavage runs in three rectangular directions.

Gypsum is of wide geographical and geological distribution. In Ontario it is found in Silurian, and in Nova Scotia and New Brunswick in Carboniferous formations underlying the productive coal measures.

Large amounts of exceptionally pure gypsum are quarried in Nova Scotia and New Brunswick and exported to the United States. Crude gypsum is worth slightly more than $1 per ton at the quarry.

Gypsum is mostly used in the manufacture of plaster of Paris, stucco, cement plaster, hard-finish plaster and as a retarder in Portland cement. When ground without calcining it is used as a low-grade fertilizer.

The demand for gypsum is steady. The deposits of the Maritime Provinces could be worked profitably on a much larger scale than is now the case.

INFUSORIAL EARTH.

Infusorial earth (tripolite, diatomaceous earth) is the accumulation of the siliceous shells of infusoria. It is found occupying lake bottoms in several counties of the Maritime Provinces. One of the largest deposits, at Bass River, Colchester County, Nova Scotia, has been worked for some years. The infusorial earth obtained there is of remarkable purity.

Infusorial earth is also found near St. John, New Brunswick, and in King's County in the same Province. A deposit covering several acres occurs in Lac Michel, Montcalm County, Quebec.

The uses of infusorial earth are many. It is utilized as an absorbent for nitroglycerine in the manufacture of dynamite. In the paint industry it is used as a wood filler, also as packing for boilers, in fire and heat retarding cements, and in vulcanized rubber. As a jewelers' abrasive it is sold under the name of electro-silicon.

Except in the case of the Bass River deposit, but little work has been done. The industry should be remunerative.

IRON.

As with gold, the iron deposits and the iron industry will be touched upon in the sections devoted to each Province.

Iron Ore is mined in Ontario, Nova Scotia, Quebec, British Columbia and New Brunswick. The importance of these operations is greatest in Ontario and least in New Brunswick.

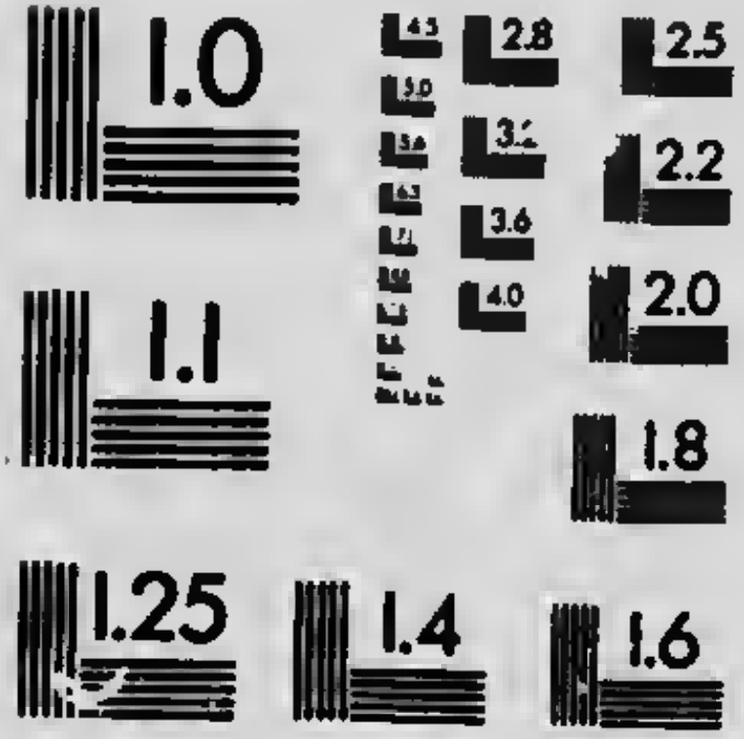
Canadian and foreign ores are smelted in Ontario, Quebec and Nova Scotia. In Ontario and Nova Scotia large steel industries flourish.

Nova Scotia possesses large deposits of magnetite, hematite, limonite, gothite, bog ore, and paint ores, along with the carbonates siderite and ankerite. Near Bathurst, in northern New Brunswick, a valuable deposite of magnetite is being opened up. Besides deposits of bog ore Quebec has vast bodies of titaniferous magnetite. The magnetic sands on the north shore of this Province have been concentrated successfully and when capital has been devoted to their exploitation they will form the basis of a large industry.

The Helen mine in the Michipicoten district, where a high grade hematite is mined, the Moose Mountain magnetite mine near Sudbury, and the Bessemer mine in North Hastings, are the principal ore producers of Ontario. But

MICROCOPY RESOLUTION TEST CHART

(ANSI and ISO TEST CHART No. 2)



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iron ore deposits are scattered practically all over the northern and western sections of the Province.

There are numerous known and prospected deposits of magnetite in British Columbia. The only iron ore mining is done near Quatsino Sound, from which point some thousands of tons of bog ore have been shipped to Seattle, U.S.A.

In the Province of Ontario extensive beds of iron ochre occur in Norfolk, Haltou, Sydenham and Simcoe Counties. Excellent iron ochres are mined and calcined at Three Rivers and St. Malo, in Quebec. Both crude and calcined ochres are shipped to points in Canada and the United States. Ochre is also found in large quantities at Londonderry, Nova Scotia. It is one of the unexploited sources of wealth.

LEAD.

The entire output of lead in Canada comes from British Columbia, where, in 1907, 47,738,703 pounds of lead, worth $2,291,458, were produced. During four years, ending 1906, Ontario produced $106,500 worth of pig lead. But the industry has been suspended in this Province.

The Fort Steele Mining Division of British Columbia produced 78.61 per cent. of the total recorded above. The greater part of this is credited to the St. Eugene Mine, at Moyie, on Moyie Lake.

Galena (galenite) is the principal ore of lead. It is, chemically, lead sulphide (Pb S), lead 86.6 per cent., sulphur 13.4 per cent. It is a fairly soft mineral, lead-gray in color and streak. Its heaviness and its perfect cubic cleavage are its distinguishing marks. Although usually found in distinct cubes of various sizes, it is often massive.

Galena is soluble in nitric acid. Associated with pyrite, zincblende, chalcopyrite, and mispickel in a gangue of calcite, quartz, barite, or fluorite, it is an important constituent of veins. It occurs in beds and veins in crystalline and uncrystalline rocks.

Galena ores are of frequent occurrence in New Brunswick and Nova Scotia. Here they are silver-bearing and, in some cases, carry gold in small amounts. Many veins, some of commercial size, have been discovered in the Huronian and Laurentian rocks of Ontario and Quebec. The galenas of British Columbia are more valuable as ores of silver.

LIMONITE.

Limonite, the hydrated sesquioxide of iron ($2\ Fe_2\ O_3 + 3\ H_2\ O$), has a silky or submetallic lustre. The surface is often a shining jet-black. Fracture surfaces are dull shades of brown. The streak is a distinctive yellowish-brown as opposed to the red streak of hematite and the black streak of magnetite. Limonite often occurs in the form of lustrous botryoidal (grape-like) and stalactitic masses. It is also compact and lustreless.

Limonite is found in secondary deposits associated with barytes, siderite, ankerite, calcite and quartz. It is one of the purest ores of iron. The Nova Scotian limonite is free from phosphorus, but contains from 0.5 per cent. to 2 per cent. manganese.

MANGANESE.

But very few tons of manganese ores are produced in Canada. Occasionally a year passes without any record of production.

Manganese ores are in strong demand in the United States and a Canadian market could easily be developed.

In addition to many minor uses, manganese ores have important functions to perform in the iron and steel industries. They are also used largely in the manufacture of chlorine, of oxygen, and of potassium permanganate.

For metallurgical purposes their value depends upon the percentage of manganese present and upon the absence of harmful quantities of such elements as phosphorus, sulphur, etc. In the chemical industries, on the other hand, the chief use for manganese ore is as a supplier of oxygen, and the value of the ore depends upon the percentage of manganese peroxide present. Thus an ore unsuited for one purpose may be of great value for the other.

For use in the steel industry, manganese ore carrying 50 per cent. and more of manganese is paid for at the rate of 30 cents per unit. Ores carrying 40 per cent. are graded down to 27 cents per unit. Ores running under 40 per cent. manganese and over 12 per cent. silica or 0.27 phosphorus are subject to refusal.

The chief Canadian ores of manganese are pyrolusite and manganite.

Pyrolusite is an iron-black or dark bluish steel-gray mineral. In structure it is columnar, or granular massive. Its streak is black, its lustre metallic. It is opaque and brittle. Chemically it is manganese dioxide ($Mn\ O_2$), manganese 63.2 per cent., oxygen 36.8 per cent. Chlorine is produced when pyrolusite is treated with hydrochloric acid.

Manganite is a dark steel-gray mineral giving a reddish-brown streak. It is considerably harder than pyrolusite. Its lustre is submetallic. It occurs in striated crystals grouped in bundles. It is seldom granular, but sometimes columnar and stalactitic. Manganite is hydrated manganese sesquioxide ($H_2\ Mn_2\ O_4$), manganese 62.5 per cent., oxygen 27.3 per cent., water 10.2 per cent.

Both pyrolusite and manganite, especially the former, are found in workable quantities in Nova Scotia and New Brunswick. Manganite has been mined at East River, Pictou County, N.S. There it is found in lower carboniferous limestones. At Stellarton, Pictou County; at New Ross, Lunenburg County, and at Sydney, Cape Breton, manganite is found. An important body of high grade pyrolusite exists at Tenny Cape, Hants County, N.S. Here the pyrolusite occurs with manganite, in nodules, pockets, and lenticular masses in the carboniferous limestone. It is probable that the deposits extend for many miles along a contact of the lowest beds of limestone with the underlying unconformable rocks. The ore has been mined to a depth of 75 feet. Open workings at Tenny Cape have been followed. One pocket produced one thousand tons of ore. The ore yields 88 to 95 per cent. of available oxides of manganeae.

Near the head of Hammond River, in King's County, New Brunswick, a grey limestone carries rich pockets of pyrolusite and manganite. The ore bodies were opened in 1864, but have since been abandoned.

Fine-grained pyrolusite mixed with manganite has been worked at Jordan Mountain, Sussex County, N.B. The deposit is a lenticular mass rather than a vein.

At Dawson Settlement, Albert County, N.B., a pulverulent body of manganese bog ore, from a few inches to 30 feet in thickness, was for some years worked and briquetted.

The manganese deposits of the Maritime Provinces afford one of the best opportunities for careful exploitation and economical and profitable operation. They are valuable but silent assets.

MICA.

Commercial mica is known under the name of white mica (or muscovite), amber mica (or phlogopite), and black mica (or biotite).

The second variety, amber or magnesia mica, constitutes the principal supply in Canada.

Amber mica crystallizes in thin, tough, elastic laminae or sheets. Its color is golden yellow, sometimes green, white, or colorless. Lustre pearly or submetallic. Chemically it is a silicate of alumina, carrying also potash and magnesia. It contains little or no iron.

The principal mica mining districts of Canada are situated in the western part of Quebec and the eastern section of Ontario, chiefly in the counties of Wright, Labelle, Pontiac and Lanark. The deposits occur in rocks of Laurentian age. The associated minerals are generally pyroxene and apatite in a gangue of calcite or crystalline limestone. Many mines that were formerly worked for apatite (or "phosphate rock") are now operated for the mica they contain, apatite being obtained as a by-product.

In a few localities in British Columbia and Nova Scotia mica is found in considerable bodies. Only in two or three instances is it being worked.

The three principal uses of mica are for electrical insulation, glazing, and decoration. The first-named use is at present the most important, but the other two are of great historic interest.

Scrap mica is utilized in the manufacture of boiler lagging. Ground mica is made into mica bronzes and paints, and is also used as an absorbent for explosives.

Mica brings prices that vary with the size and condition of the mineral. The largest sizes of selected and prepared mica sell for $7.00 per pound. For the smallest sizes of uncut mica only 5 cents per pound is realized.

MOLYBDENITE.

Molybdenite is a pure lead-gray mineral with a streak of similar color. It crystallizes in short or tabular hexagonal prisms and is commonly foliated, massive, or in scales, or granular. Its laminae are very flexible, but not elastic. It is very soft, has a metallic lustre, and marks paper with a bluish-gray trace. It is easily cut. Molybdenite is molybdenum sulphide (MoS_2), molybdenum 59 per cent., sulphur 41 per cent. It is easily distinguishable from graphite by its color and streak.

Molybdenite is generally found imbedded in or disseminated through granite, gneiss, granular limestone, or other crystalline rocks. It is found in all the mining provinces of Canada. Several deposits, especially in Ontario and Quebec, have been worked. The difficulties to be overcome lie in the direction of ore-dressing.

Molybdenum is used as an alloy of steel and in the laboratory in the forms of ammonium molybdate and molybdic acid. Other uses to which ammonium molybdate is put are in fire-proofing material and as a disinfectant.

When proper means have been devised for concentrating molybdenite, discovered Canadian deposits will increase enormously in value. Here is indeed one of the most enticing fields of investigation for Canadian mill-men.

NICKEL.

The two Canadian districts producing ores of this metal are Sudbury and Cobalt, both in Ontario. In the Sudbury district three sulphides make up the bulk of the ore bodies. These three are chalcopyrite, pentlandite, and pyrrhotite. Chalcopyrite has been described in a former section. The remaining two minerals we shall deal with here.

Pyrrhotite is a bronze-yellow or brownish mineral that tarnishes readily. It gives a grayish black streak, has a metallic lustre, and is magnetic. The nickel-bearing variety of this mineral contains as much as 6 per cent. nickel. In chemical composition it is a sulphide of iron usually containing iron 60.5 per cent., and sulphur 39.5 per cent., corresponding to the formula $Fe_7 S_8$. The pure pyrrhotite of Sudbury contains about 3.21 per cent. nickel.

Pentlandite, a sulphide of iron and nickel (Fe Ni) S, contains up to 35 per cent. nickel and sometimes in excess of this. It is not easily distinguishable from the pyrrhotite in which it is imbedded. But its brassy lustre or slightly weathered surfaces and its perfect octahedral cleavage are characteristic. It is probable that most, if not all, of the nickel contained in pyrrhotite occurs as pentlandite in a very finely divided state.

The Sudbury ores are unusually uniform and the district remains the world's greatest producer of nickel.

The nickel-bearing minerals of the Cobalt district are as follows:

Niccolite, an arsenide of nickel (Ni As), a light copper-red colored mineral, tarnishing dark, metallic lustre, streak brownish black, fine grained, smooth structure, usually massive.

Chloanthite, or diarsenide of nickel ($Ni As_2$), tin-white in color with a tendency towards a pinkish tint, tarnishes gray or iridescent. Streak grayish black.

Annabergite, nickel arsenate ($Ni_3 As_2 O_8 + 8 H_2 O$), or nickel bloom, is an apple-green, soft, earthy mineral.

Millerite, or nickel sulphide (Ni S), brass-yellow to bronze-yellow in color, iridescent tarnish, metallic lustre. Occurs in delicate needles or hairlike forms. Contains 64.6 per cent. nickel.

The average percentage of nickel in ores shipped from Cobalt has been estimated at between 3 and 5 per cent.

PLATINUM.

Metallic **platinum** is obtained in dredging and bydraulicking in tbe Yale and Cariboo districts nf Britisb Columbia. The mineral sperrylite, cntaining 30 per cent. platinum, is found at Copper Cliff, Ontario. Other occurrences have been noted also.

PYRITE.

Pyrite, iron pyrites, is cbemically iron disulphide ($Fe S_2$). It is one of the commonest of mineral. Metallic lustre, iridescent tarnish. Occurs in well-formed crystals, also massive and finely granular.

Enormous quantities of pyrite are used in the manufacture of sulphuric acid. Often pyrite contains enough copper, gold, or silver to constitute an ore nf these metals.

The most prominent and rapidly growing use of pyrite is in connection with the sulphite pulp industry. It is steadily replacing Sicilian brimstone.

Sulphuric acid works,operated by the Nichols Chemical Company at Sulpbide, Ontario, use five carload of pyrite per day. At Capelton, Quebec, the same company produces acid from copper-bearing pyrite. At Sydney, N.S., Newfoundlsnd iron pyrite is used; at Vancouver, B.C., Japanese sulpbur is imported.

Quebec and Ontario possess, especially in the northern districts, bountiful supplies of pyrite, limestone, and pulpwood, all of which can be secured in close proximity to each other. Here, again, is one of the largest opportunities for expansion.

QUARTZ.

The mining of quartz (crystallized silica, $Si O_2$) is a new industry. The Canadian Copper Company operates a mine in the townsbip of Waters. About 150 tons nf quartz is shipped per day to tbe copper smelters at Copper Cliff, for use as flux and for lining converters. In 1907, tbe output was 56,585 tons, valued at $124,148.

Quartz, in various conditions, bas a multiplicity of uses, sucb as a glaze for pnttery, as material for sandpaper, in the manufacture of scouring soaps, etc. Recently is has become a source of metallic silicon. Massive qusrtz is found in large bodies in pegmatite dikes in the older rocks all nver Canada. There are many available deposits untouched.

RUTILE.

Rutile, titanium dioxide ($Ti O_2$) is a mineral of reddish brown, red, yellowish or black colour. Its streak is light brown. Its fracture is uneven. It is almost as hard as quartz. Rutile occurs in tetragonal prisms, which often show deep furrows on the prism faces. Rutile is used to give tbe desired bluisb tint to artificial teetb. It is found in Quebec and Ontario.

SODALITE.

Sodalite is a silicate of alumina and sodium. It bas a greasy lustre and a blue, gray nr white green color. It occurs massive or in disseminated

grains. It is used in the fine arts and in jewelry. There is a large deposit in Dungannon Township, Ontario.

TALC.

Talc is a hydrated silicate of magnesia. It is a white or greenish-white soft mineral, greasy to the touch. It is valuable, when ground, as a filler for rubber, paper, leather, etc., and enters into many commercial products. The unground talc, channelled in blocks, is used to make a variety of articles.

Talc sells for from $8 to $40, according to grade and purity.

A deposit is worked at Madoc, Ont. Several deposits are known in Quebec and in Nova Scotia.

TIN.

The principal tin-bearing mineral is cassiterite, a heavy, hard mineral usually black in color, although sometimes red, gray, white, or yellow. Cassiterite is tin oxide ($Sn O_2$), containing, when pure, 78.6 per cent. of tin. Its most common occurrences are in veins traversing granite, gneiss, mica, schist, etc. It is found as a constituent of pegmatite veins. Placer deposits are the principal sources of the world supply.

In Canada the chief occurrence is at New Ross, Nova Scotia.

TUNGSTEN.

Wolframite, a dark, hard, heavy mineral, the tungstate of iron and manganese, contains 76.47 per cent. tungsten trioxide. It is the principal ore of tungsten. It is found associated with tin ores and in quartz veins. In Halifax County, N.S., a 4-inch vein of scheelite (calcium tungstate), and wolframite has recently been found.

ZINC.

Sphalerite, zinc-blende, zinc-sulphide, (Zn S) is a black, brown, yellow, or white mineral containing 67 per cent. zinc. It is one of the commonest vein minerals.

Only one mine, the Olden, in Frontenac County, Ont., is worked as a zinc mine in Canada. Otherwise the sulphide is obtained as a by-product from lead and silver mines.

Annual Mineral Production of Canada since 1886.

1886	$10,221,255	1897	$28,485,023
1887	10,321,331	1898	38,412,431
1888	12,518,894	1899	49,234,005
1889	14,013,113	1900	64,420,983
1900	16,763,353	1901	65,804,611
1891	18,976,616	1902	63,211,634
1892	16,623,415	1903	61,740,513
1893	20,035,082	1904	60,073,897
1894	19,931,158	1905	69,525,170
1895	20,505,917	1906	79,057,308
1896	22,474,256	1907	86,183,477

Mineral Production of Canada in 1907.

Metallic.		Quantity.	Value.
			$
Antimony ore	Tons.	2,016	65,000
Copper	Lbs.	57,381,746	11,478,644
Gold—Yukon	$3,150,000		
Gold—All other	5,114,765		
		.....	8,264,765
Iron ore (exports (c)	Tons.	25,901	45,907
Pig iron from Canadian ore (d)	Tons.	107,599	1,982,307
Leads (e)	Lbs.	47,565,000	2,532,836
Nickel (f)	Lbs.	21,189,793	9,535,407
Silver (g)	Oz.	12,750,044	8,329,221
Cobalt, zinc, and other metallic products		.....	200,000
Total metallic		.....	42,434,037

Non-Metallic.		Quantity.	Value. $
Arsenic (refined)	Lbs.	660,080	36,210
Asbestos	Short tons.	62,018	2,482,984
Asbestic	Short tons.	28,519	22,059
Chromite	Short tons.	7,196	72,901
Coal	Short tons.	10,510,961	24,560,238
Peat	Short tons.	50	200
Corundum	Short tons.	1,892	177,922
Feldspar	Short tons.	12,584	29,809
Graphite	Short tons.	579	16,000
Grindstones	Short tons.	5,382	46,876
Gypsum	Short tons.	475,508	642,470
Limestone for flux in iron furnaces	Short tons.	359,503	298,097
Mica	Short tons.	.....	333,022
Mineral Pigments—Barytes	Short tons.	2,016	4,500
Mineral Pigments—Ochres	Short tons.	5,828	35,570
Mineral water	Galls.	250,985	110,524
Natural gas (*h*)			748,581
Petroleum (i)	Bbls.	788,872	1,057,088
Phosphate	Tons.	750	5,514
Pyrites	Tons.	39,133	189,353
Salt	Tons.	72,697	342,315
Talc	Tons.	1,534	4,602
Tripolite	Tons.	30	225
Total			31,217,060

(*a*) Quantity of product sold or shipped.

(*b*) The metals, copper, lead, nickel and silver, are, for statistical and comparative purposes, valued at the final average value of the refined metal in New York. Pig iron is valued at the furnace, and non-metallic products at the mine or point of shipment.

(*c*) Copper contents of ore, matte, &c., at 20.004 cents per pound.

(*d*) The total production of pig iron in Canada in 1907 was 651,962 short tons, valued at $9,125,226, of which it is estimated about 107,599 tons valued at $1,982,307 should be attributed to Canadian ore, and 544,363 tons valued at $7,142,919 to the ore imported.

(*e*) Lead contents of ore matte, &c., at 5,325 cents per lb.

(*f*) Nickel contents of matte shipped at 45 cents per lb.

(*g*) Silver contents of ore, &c., at 65.327 cents per lb.

(*h*) Gross return from sale of gas. Additional returns increase this item to $803,908.

(*i*) Deduced from the amount paid in bounties and valued at $1.34 per barrel.

Structural Materials and Clay Products.	Quantity	Value. $
Cement—natural rock—Bbls.	5,775	4,043
Cement—Portland—Bbls.	2,368,593	3,374,828
Flagstones—Sq. yds.	3,000	2,550
Sands and gravels—(exports)—Tons	298,095	119,853
Slate—Squares	4,335	20,056
Building material, including bricks, building stone, lime, &c., estimated on the basis of production in 1906	.....	7,500,000
Total structural materials and clay products	.....	12,232,330
Total all other non-metallic	.....	31,217,060
Total non-metallic	.....	43,449,390
Total metallic	.....	42,434,087
Estimated value of mineral products not returned	.....	300,000
Total, 1907	.....	86,183,477

INCREASE AND DECREASE.

Products.	Increase. $	Decrease. $
Copper	758,170	
Gold, Yukon	.....	2,450,000
Gold, all other	.....	780,436
Pig iron, (from Canadian ore)	257,907	
Lead	.....	556,351
Nickel	586,573	
Silver	2,669,766	
Other metallic products	137,930	
Asbestos	444,900	
Chromite	.....	18,958
Coal	4,828,219	
Corundum	.....	27,051
Gypsum	.....	824
Natural gas	182,160	
Petroleum	295,328	
Portland cement	210,021	
Other net increases	588,815	
	10,959,789	3,833,620
Total increase	7,126,169	

PER CENT. INCREASE AND DECREASE.

Metallic—				
Copper	3.18	....	7.07	....
Gold	....	....	....	28.10
Pig iron (from Canadian ore only)	2.79	....	14.95	....
Pig iron (from both home and imported ore)	8.94	....	16.64	....
Lead	....	12.89	....	18.01
Nickel	....	1.40	6.55	....
Silver	50.47	....	47.17	....
Non-metallic—				
Asbestos and asbestic	10.16	....	21.59	....
Coal	7.66	....	24.47	....
Corundum	....	16.79	....	13.19
Feldspar	....	25.75	....	27.1
Gypsum	13.55	....	....	.13
Natural gas	....	....	31.21	....
Petroleum	38.45	....	38.77	....
Portland cement	11.74	....	6.63	....

RELATIVE IMPORTANCE OF VARIOUS MINERAL INDUSTRIES.

1906. Products.		1907. Products.	
1. Coal	24.93	1. Coal	28.498
2. Gold	15.03	2. Copper	13.318
3. Copper	13.74	3. Nickel	11.064
4. Nickel	11.19	4. Silver	9.664
5. Brick, stone and lime	8.00	5. Gold	9.589
6. Silver	7.15	6. Brick, stone and lime	8.702
7. Cement	3.96	7. Cement	3.915
8. Lead	3.83	8. Lead	2.938
9. Asbestos	2.49	9. Asbestos	2.906
10. Pig iron (from Canadian ore)	2.16	10. Pig iron (from Canadian ore)	2,300
11. Petroleum	.95	11. Petroleum	1,226
12. Gypsum	.74	12. Natural gas	.888
		13. Gypsum	.745

IRON AND STEEL BOUNTIES.

	Quantity.	Bounty.
Pig iron, made from Canadian ore	95,914.97	20',421 47
Pig iron, made from imported ore	537,803.45	591,583 80
Total pig iron	633,718.42	793,005 27
Steel ingots	666,589.87	1,099,873 37
Steel wire rods	68,738.22	412,417 26
Total bounty paid on iron and steel	.....	2,305,295 90

COAL OUTPUT OF THE DOMINION.

	Tons of 2,000 lbs.	Value.
		$
Nova Scotia	6,337,632	12,731,850
New Brunswick	34,584	77,814
Saskatchewan	153,914	259,019
Alberta	1,534,001	3,819,587
Yukon	15,000	60,000
British Columbia	2,435,830	7,611,968
Total	10,510,961	24,560,238

Nova Scotia.

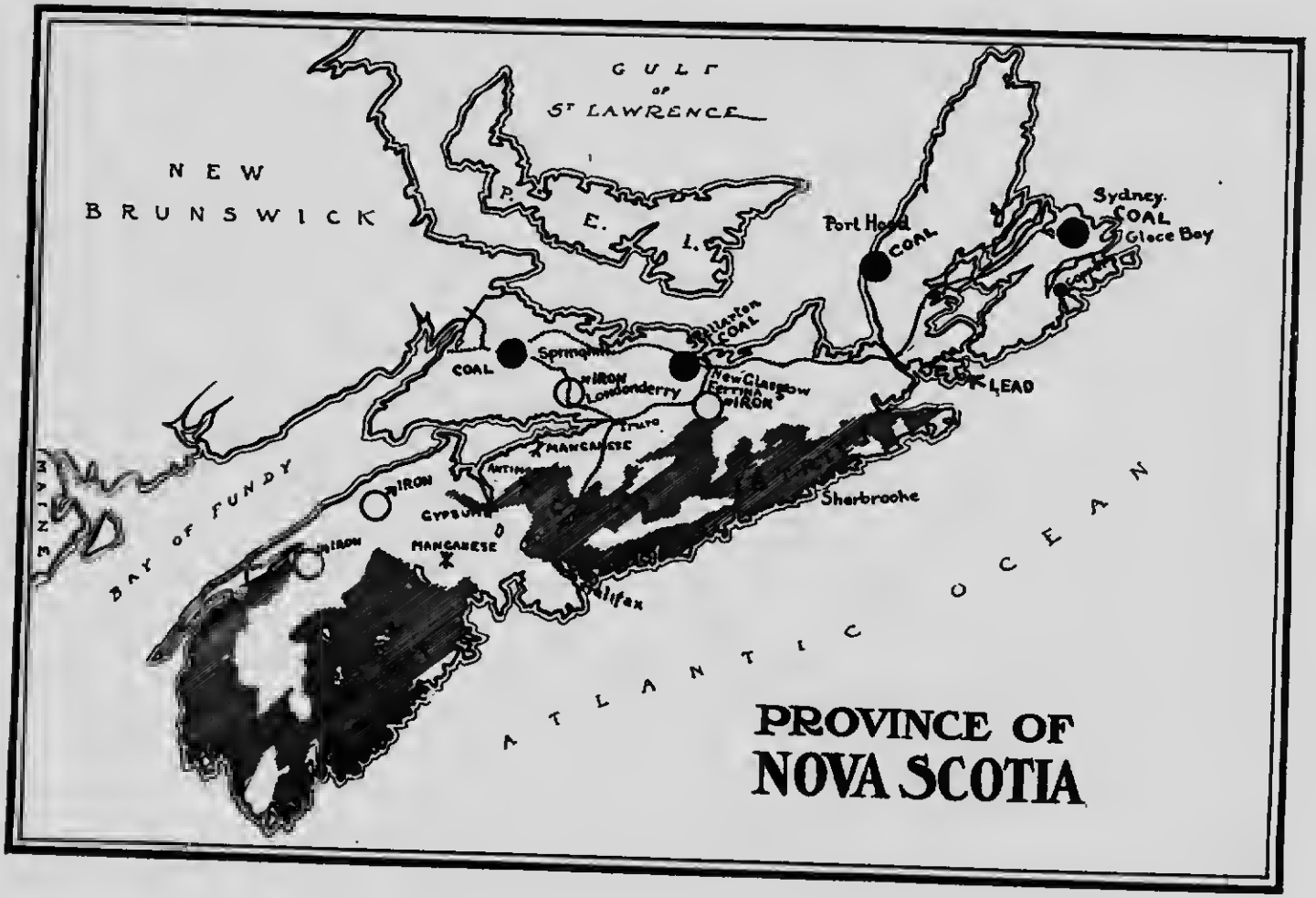
COAL.

The beginnings of mining in Nova Scotia are coloured with historic interest. The oldest authentic record of the discovery of coal is a French memoir dated 1672. Early in the eighteenth century, about 1720, coal was mined at Cow Bay (now Port Morien), Cape Breton, to supply New England. Some years later these activities met the disapproval of Great Britain, whose desire to control the markets of the New World led to friction and incidental bloodshed. Indeed in the year 1770 the "Block House" mines at Cow Bay were closed by a royal proclamation prohibiting the mining or shipment of coal in Cape Breton. Despite these repressive measures coal mining was continued surreptitiously, or in open defiance of the authorities. These conditions did not last long. At Cow Bay private operators were granted leases and at Sydney Mine state operated collieries were opened. The latter however, were turned over to a private corporation in 1788. Henceforward private leasing became and continued to be the only system pursued.

The Imperial Government, in making grants of land, reserved for the Crown all mineral rights. A strong aggregation of British capitalists, the General Mining Association, acquired an almost complete leasehold monopoly of these rights in 1827. Both the Cape Breton and the Pictou fields fell into their hands. At that time the total coal sales for the whole of Nova Scotia amounted to 12,149 tons. The Association expended the equivalent of about $1,500,000 in opening new collieries, and production was increased gradually, but substantially.

The recorded coal sales for the 31 years during which the Asociation's monopoly held reached their maximum (294,198 tons) in 1857. During the following year the monopoly was broken and the Association surrendered to the Crown many square miles of its holdings.

The period 1854-1866, during which the United States coal duties were removed, witnessed an expansion of the trade with the New England States. The tonnage of coal exported reached the relatively large amount of about half a million tons. But after the resumption of the duty in 1867 exports to the United States dwindled rapidly. Meanwhile other influences were at work. The confederation of Upper and Lower Canada brought about an enlargement of the St. Lawrence trade. A protective duty excluded British fuels, and local consumption grew perceptibly. From the year of Confederation onward the coal industry made steady progress. The event of greatest moment in its recent history was the birth of the Dominion Coal Company. This corporation, organized in 1893, obtained a ninety-nine years' lease from the Nova Scotia government in that year. Its holdings comprise about 150 square miles of coal-bearing territory easily accessible from tide-water. Under


GULF
of
St LAWRENCE
NEW
BRUNSWICK
P.
E.
I.
Port Hood
COAL
Sydney
COAL
Glace Bay
COAL
Springhill
IRON
Londonderry
New Glasgow
IRON
LEAD
MANGANESE
IRON
GYPSUM
MANGANESE
Sherbrooke
Halifax
BAY of FUNDY
MAINE
ATLANTIC
OCEAN
PROVINCE OF
NOVA SCOTIA

its systematic operations the production of the Sydney coal field has been enormously enhanced. In fifteen years it has produced more coal by 50 per cent. than was produced in the 35 years that preceded its inception.

The markets supplied by the collieries of Nova Scotia are indicated by the following statement of coal sold during 1907:

Nova Scotia	1,842,419	tons.
Quebec	1,704,592	"
United States	616,312	"
New Brunswick	427,128	"
Bunker	204,572	"
Newfoundland	146,502	"
Prince Edward Island	77,493	"
Other Countries	12,483	"
Mexico	7,591	"
West Indies	2,508	"
	5,046,690	"

It will be seen that, next to the home demand, the St. Lawrence (Quebec) trade is the most important item. The hulk of this coal is transported by water between the months of May and October while the St. Lawrence is open to navigation.

Nova Scotian coal is bituminous. There is no anthracite in the Province. In quality and in appearance the coals from different districts vary widely. Cape Breton coals usually carry a larger percentage of sulphur than do the Pictou, Colchester, and Cumberland coals, but the former yield a lower ash. Almost without exception the coals of the Province can be coked, some without elimination of impurities, and others only after sizing and washing. Both steam and domestic fuels are produced in abundance. In all the mining counties there are large untouched reserves, and much of the coal-bearing territory has not yet been systematically explored. The area of coal field already discovered is about 1,000 square miles. On the most modest estimate, there are some billions of tons of coal yet to be won.

The Provincial Government exacts a royalty of ten per cent. per ton on all coal sold.

Nova Scotia's geographical situation and the consideration that it is the only coal producing country on the whole Atlantic coast of this continent whose coal deposits are at tidewater lends tremendous importance to the development of its fuel resources. That the Vancouver Island deposits occupy an analogous position in relation to the Pacific coast gives assurance of Canada's future in the markets of the North American continent.

As mentioned above, the coal-fields of Nova Scotia are all on, or near, tidewater. On the island of Cape Breton, four important companies operate—the Dominion Coal Company, the Nova Scotia Steel and Coal Company, the Inverness Railway and Coal Company, and the Port Hood-Richmond Coal and Railway Company. There are, in addition, several new companies opening fresh ground, or rehabilitating old mines.

The **Dominion Coal Company's** holdings and operations are far too extensive even to outline here. It controls the Glace Bay aection, where its holdings comprise 140 square miles, with six workahle seams, ranging from six to ten feet in thickness. The overground and underground equipment of the Dominion Coal Company's twelve mines is moat modern and complete. Its total production for the year ending Septemher 30th, 1907, was 3,456,937 tons; about 60 per cent. of the whole output of the Province. With its magnificent ahipping and unloading facilities nesr the collieries and at Montreal, the Dominion Company has developed a large St. Lawrence trade. In addition to this it supplies a strong domestic demand and furnishes the Dominion Iron and Steel Company with coking coal. An analyaia of coal from the Emery seam ahows the character of the coal:—

Volatile comhustiles	31.10
Fixed Carbon	63.10
Aah	3.65
Moisture	0.64
Sulphur	1.51

The Dominion Coal Company pays to the Provincial Government a royalty of 12½ cents per long ton on all cosl raiaed.

The Nova Scotia Steel and Coal Company own about 15,000 acres of coal lands at Sydney Mines, on the north side of Sydney Harhor. About one-fifth of these holdings are suhmarine areas. From its several collieries 664,404 tons were raised in 1907. Besides supplying the company's hlast-furnaces and steel works, the coal is in demand for domestic purposes.

The Inverness Railway and Coal Company operatea a colliery at Broad Cove, on the west coast of Cape Breton, ahout sixty miles from the Straits of Canso. The cosl produced is sold in Quebec and Nova Scotia. The company operates ahout fifty miles of railway. In 1907 the output was 261,004 tons.

The Port Hood-Richmond C. & R. Company owns a colliery at Port Hood, a few miles south-west of Broad Cove. The output for 1907 was 76,083 tons. It has heen greatly increaaed lately. This company poasesses one of the very few good hsrbours cn the west coast of Cape Breton.

The Pictou County coal field forms a main east and west syncline, covering about 35 aquarc miles. The seams are from 3 feet to 30 feet in thickness. The two principsl opersting companies are the Intercolonial Coal Mining Company and the Acadia Coal Company.

The Intercolonial Coal Mining Company owna ahout eight square miles of coal areas at Westville and operatea the Drummond colliery st that plsce and produces about 1,000 tons of coal per day. Fire clay is mined under one of the coal seams and is manufactured into brick at Westville.

The Acadia Coal Company owns sixteen square miles of coal landa and operatea a group of collieries near Stellarton. The Company's output of coal in 1907 was 385,006 tons.

The Cumberland County coal fields extends over a known area of 350 square miles. Its northern edge hegins at the Joggins, on Chignecto Bay.

The Cumberland Railway and Coal Company operates the chief colliery, althongh there are several growing concerns working on a relatively small acale. The C. R. & C. Company's colliery is situated at Springhill. Here three aeams, 6 to 15 feet thick, are worked. The output last year was 339,039 tons. The Springhill coal ia excellent for steaming purposes. It is shipped on a branch line to the main line of the Intercolonial Railway, or over the Company's own railway, 30 miles, to Parrsboro, on the Bay of Fundy.

GOLD.

Coal mining had long been an established industry when gold was first discovered in Nova Scotia. Vague reports of gold finds were circulated in the early "fifties," and Dr. Dawson in 1855 expressed the opinion in his "Acadian Geology" that gold would probably be found in the rocks of the south-east Atlantic coast. But it was not until 1857 that the first actual discovery was made. That honour is credited to Mr. John Campbell, who was described by a contemporary as "a gentleman of considerable scientific attainments." Mr. Campbell obtained gold by washing the sand of a beach near Halifax harbour, and for some time after thia event he applied his energies to prospecting for the metal. His ohservations on the vein occurrences were of distinct value.

The next recorded discoveries were made in the Tangier country by Lieut. C. L.'Estrange, R.A., in 1858, and hy John Pulsifer, a farmer, in 1860. The latter discovery attracted immediate attention, and in the excitement that followed hundreds flocked to Tangier River, about forty miles north-east of Halifax. Fresh discoveries were made in March, 1861, and in 1862 the Government appointed a Gold Commissioner.

The official record of the gold yield of the Province for the year 1862 was 7,275 ounces extracted from 6,473 tons crushed.

The principal gold fields were at that time divided into claims of twenty feet hy fifty feet, and a yearly license fee of $20 was exacted by the Government for each claim. The present unit area is a rectangle measuring 250 feet by 150 feet. Any number of these areas, not exceeding 100, can he taken up by individual applicants. The fee is nominal.

The output of 1867, the climax of the first excitement, was not exceeded until 1898, when 86,331 tons of ore crushed yielded 31,109 ounces of gold. The period from 1896 to 1903 was marked by annual gold productions exceeding $500,000 in value. Since then tbere has heen a gradual diminution, although for the year 1907 the returns were larger than for the preceding year. Including the gold from stibnite ore mined at West Gore, Hants County, the total yield for the Province was 15,006 ounces valued at $285,114. The average yield in the atamps-mills, from amalgamation alone, ranged from $3.50 to $19 per ton.

The gold fields of Nova Scotia, exclnding granite intrusions, cover about 3,000 square miles. The gold-bearing rocks are divided into two groups—the lower, or quartzite, group; and the upper, or ferruginous and graphite slate, group. The thickness of the lower group has heen estimated hy Faribault to be 11,000 feet. It consists of quartzite, inter-stratified with numerous beds of slate and occasional beds of conglomerate. The upper group, 4,000 feet thick,

is almost wholly composed of bluish-black soft slates. Both groups have been folded into a series of synclines and anticlines nearly parallel to the coast line. The rocks dip at angles of 75 deg. to 90 deg., seldom lower than 45 deg., and overturns are frequently noted. The folds of the measures have been greatly denuded. In many places horizontal sections are exposed, showing the reverse dips to north and south.

The anticlinal folds, along their crests, have a decided pitch in opposite directions. Domes are thus formed at intervals of from ten to twenty miles, and on these domes the strata have loosened and opened. In the openings thus created, gold-bearing veins, superimposed in vertical, or nearly vertical, succesion, have been injected. Almost invariably the domes have proved to be most profitable points of attack. More than fifty such centres have been exploited.

The gold-bearing quartz veins of Nova Scotia, intercalated between the folded layers of quartzite and slate, extend in many cases for thousands of feet. In vertical depth they have been followed in one or two instances for 700 feet.

The veins range in width from an inch up to twelve or fifteen feet, the richest being not more than fifteen inches. The gangue is quartz of various texture and colour. The usual associated minerals are iron, copper, lead, and zinc sulphides, generally in small amounts, not exceeding two to five per cent. of the total vein matter. Gold is present in the free state, often in large nuggets and irregular patches, most frequently in microscopic particles. Usually the gold is concentrated in pay streaks with well-defined limits. Sometimes, however, it is distributed regularly throughout the vein.

Both the quartzite beds and the slates carry appreciable amounts of the precious metal. The slates, when in contact with quartz, often show visible platings and sprinklings of gold.

Exhaustive investigation of the battery tailings and concentrates from fifteen gold districts gave some instructive results. In gold contents the tailings from the plates ranged from traces up to $15; and in one case, where amalgam was being lost, the plate tailings ran up to over $40 per ton. In this instance only $2.00 in free milling gold was being recovered. Similarly tailings from dumps carried from 60 cents to $7 per ton. The concentrates ran all the way from $3 per ton to $260, in most cases being well over $20. Again, instances were found of heavy losses of amalgam.

Facts such as these demonstrate the need of careful and scientific treatment. The wasteful methods so long in vogue in Nova Scotia undoubtedly injured the industry. Bonanzas were looked for and economy was given no thought. That even the lower grade ores can be made to yield a fair profit has been proved by the operations of the Boston-Richardson gold mine at Isaac's Harbor, Guysboro County. Here an ore, assaying about $3 to the ton, is worked successfully. Concentrates, largely mispickel, amounting to from 2 per cent. to 5 per cent. of the total weight of the ore, are treated with bromocyanide. Their value is about $17 per ton. The cost of concentrating and cyaniding is, roughly, $2.40 per ton, or 10 to 11 cents per ton of ore. An 85 per cent. extraction is attained. Mining, stamp-milling, concentrating, and cyanide total about $1.90 per ton. A good profit remains. As operations are

enlarged the profit will iucrease. There is no douht that similar work could he performed in other Nova Scotian districts.

However, much of Nova Scotia'a gold ore is bonanza ore. Returns of five ounces to the ton, from small stamp mills, are not infrequent. In the older mines thia is seldom the case. But there is not a camp in which pay-ore does not exist in workahle quantity.

Since 1862 the gold mines of Nova Scotia have yielded gold to the value of $16,435,421. To this total the chief contributing districts have been as follows:—

Sherhrooke	$2,906,502
Stormont	1,919,599
Waverley	1,329,630
Oldham	1,111,971
Caribou and Moose River (since 1869)	1,042,974
Renfrew	857,558
Uniacke (since 1866)	832,747
Montague	797,700
Salmon River (since 1883)	792,291
Brookfield (since 1887)	734,534

Of '.ese diatricta all hut two are still active.

The average cost of coal at the mines has been estimated at $3.72 per ton, or about 51 cents per ton of gold ore mined and milled. Wages are low and trained miners of the highest type are ohtainable. Shift hosses receive $2.00 per day; machine drill men, $1.75; helpers, $1.50; timbermen, $1.75; firemen, $1.60; ordinary labour, $1.35.

The projected railway through the north-eastern part of Nova Scotia will cheapen transportation snhstantially for a large number of gold-mines. Many of the mines, however, are situated on, or near, tidewater.

Mining is now carried on in seventeen districts, at twenty-six different mines. Last year's returns showed an average yield of $4.02 per ton of ore mined and milled, or 13,687 ounces ($260,053) extracted from 64,657 tons of ore.

IRON.

It is out of the question to attempt a description of the iro nd steel industriea within the limits of this section. Brief mention of these must auffice.

Although the presence of iron ore in the trap rock near the Bay of Fundy was noted in 1604, no amelting was attempted until about the year 1810, when a Catalan forge was huilt at Nictaux in the Annapolis Valley. Only a small quantity of har iron was turned out. A smelting plant was established on the east bank of the Moose River in 1825 and good charcoal iron was produced for a short time. In 1828 the General Mining Association attempted unsuccessfully to smelt the iron ores of Pictou County.

The Acadia Iron Works at Londonderry, Colchester County, employed first a Catalan forge. A charcoal furnace was erected in 1853 and was kept in operation until 1874.

The Steel Company of Canada, in 1873, acquired the Londonderry works, added largely to the equipment, and ran themselves hopelessly into debt. The concern was reorganized in 1887 under the name of the Londonderry Iron Company which also proved unsuccessful. In 1899 the whole of the plant and mines, including blast-furnace, coke ovens, foundry, and branch railway, was purchased by the Messrs. Drummond of Montreal. Under the name of the Londonderry Iron and Mining Company, the plant has been operated ever since.

In addition to the historic Londonderry enterprise, the other, and more important concerns are the Nova Scotia Steel and Coal Company, with plants situated at North Sydney and New Glasgow, coal mines at both places, and large iron ore lands on Bell Island, Newfoundland; and the Dominion Iron and Steel Company operating a large iron and steel works at Sydney and likewise owning iron ore deposits on Bell Island. The plants of both of these concerns have been often and fully described.

Iron Ores of Nova Scotia.—At and near Londonderry, Colchester County, and at many places within a radius of 20 miles, specular hematite, limonite, red and yellow ochres or paint ores, ankerite, and siderite occur in banded metamorphic shales and quartzites. The series has a general east and west strike and parallels the axis of the Cobequid Hills. In smelting these ores, the ankerite and siderite are used as fluxes instead of limestone. The ores have been found to a depth of 400 feet. The ore-bodies are irregular, and the future of the district depends upon improved mining and handling facilities.

What are probably the most important deposits of iron ore are found in Annapolis County, at Nictaux and Torbrook. They are owned by the same group that controls Londonderry. The ore occurs in an elongated basin, more than seven miles long and three miles wide. Both red hematites and grey magnetites are mined in the districts. They usually carry between 0.5 per cent. and 1.1 per cent. phosphorus. Often the ores contain enough lime to flux off the contained silica. There are seven or eight veins from 7 feet to 40 feet in thickness. The mines are situated near tide-water and substantial water power is available.

The Arisaig hematite beds, on the north shore of Antigonish County, contain bodies of good ore and much that is very siliceous. Lately the district has been prospected more thoroughly and richer ore has been encountered. In the northern and eastern parts of Guysboro County exceedingly rich specular hematite has been found in beds and veins.

In Pictou County workable deposits of hematite, limonite and siderite, some of them of unusual size, are known.

Bog iron ore has been discovered in Halifax, Hants and other counties.

In Cape Breton magnetite, specular ore, and limonite have been found and worked at George River Mountain, Grand Mira, Boisdale Mountains, St. Peter's and many other places.

Except the Torbrook and Londonderry deposits, hardly any of the larger iron ore bodies have been given a fair trial. Systematic and vigorous

prospecting is needed. Everywhere limestone, coal and suitable coke can be obtained cheaply and in abundance.

COPPER.

What is true of the iron-ore deposits of Nova Scotia is doubly true of the copper deposits. What work has been done has borne little fruit because of the small amount of capital obtainable for exploitation.

Mining operations are carried on by three companies, the Colonial Copper Company, at Cape D'Or; the Sterling Mining Company, at Waugh's River; and the Cumberland Copper Company, near Wentworth. A total of 2,741 tons of ore was mined in 1907.

In Cape Breton, at Gabarus, Coxheath, George's River, and Cheticamp copper ores occur in the pre-Cambrian felsites. They are also found in carboniferous strata.

MISCELLANEOUS MINERALS.

The quarrying of gypsum is second in importance to coal mining in Nova Scotia. Quarries are operated in Hants, Cumberland and Victoria counties.

Ores of antimony, manganese, lead, tungsten; infusorial earth, building stones, fire-clay, brick-clay, etc., are among the other mineral resources of the province. These have been given more extended notice in the first section of this volume.

New Brunswick.

More than one-half the area of New Brunswick is occupied by carboniferous rocks. These stretch over the eastern part of the Province. The western portion is largely made up of slates, while to the northwest Silurian limestones and slates are found.

In former years large quantities of iron and mangenese ores and alhertite were produced. But work was for long discontinued for various reasons. For 20 years, starting in 1848, a blast furnace was operated at Woodstock.

The hematites of Carleton County were utilized. Iron ores have been noted at several localities on the Bay of Fundy, and at Lepreaux in Charlotte County. The latter deposit has been investigated and may prove of economic value. The most important deposit, however, that has come to light is that recently acquired by the Drummond Mines, Limited, near Bathurst. Here an extensive body of magnetite, much of which is high grade, is now being worked. Water power is to be developed from a near-hy river. There is apparently no question as to either ths value or the extent of this deposit, and its exploitation will mean much for the Province.

Small, hut increasing, quantities of hituminous coal are produced annnally. The Newcastle coal basin covers about 100 squars miles in the Grand Lake District. The coal mines are mainly in the vicinity of Newcastle River, on the Salmon River, and near Coal Creek. Until a few years ago the annual output did not exceed 6,000 tons. Last year (1907) 34,584 tons were mined. There are hut two or thres seams, less than two feet in thickness, hut the supply is practically inexhaustible. Singularly, little prospecting has heen done, although there is ample reason to suppose that other districts contain veins of workahle size.

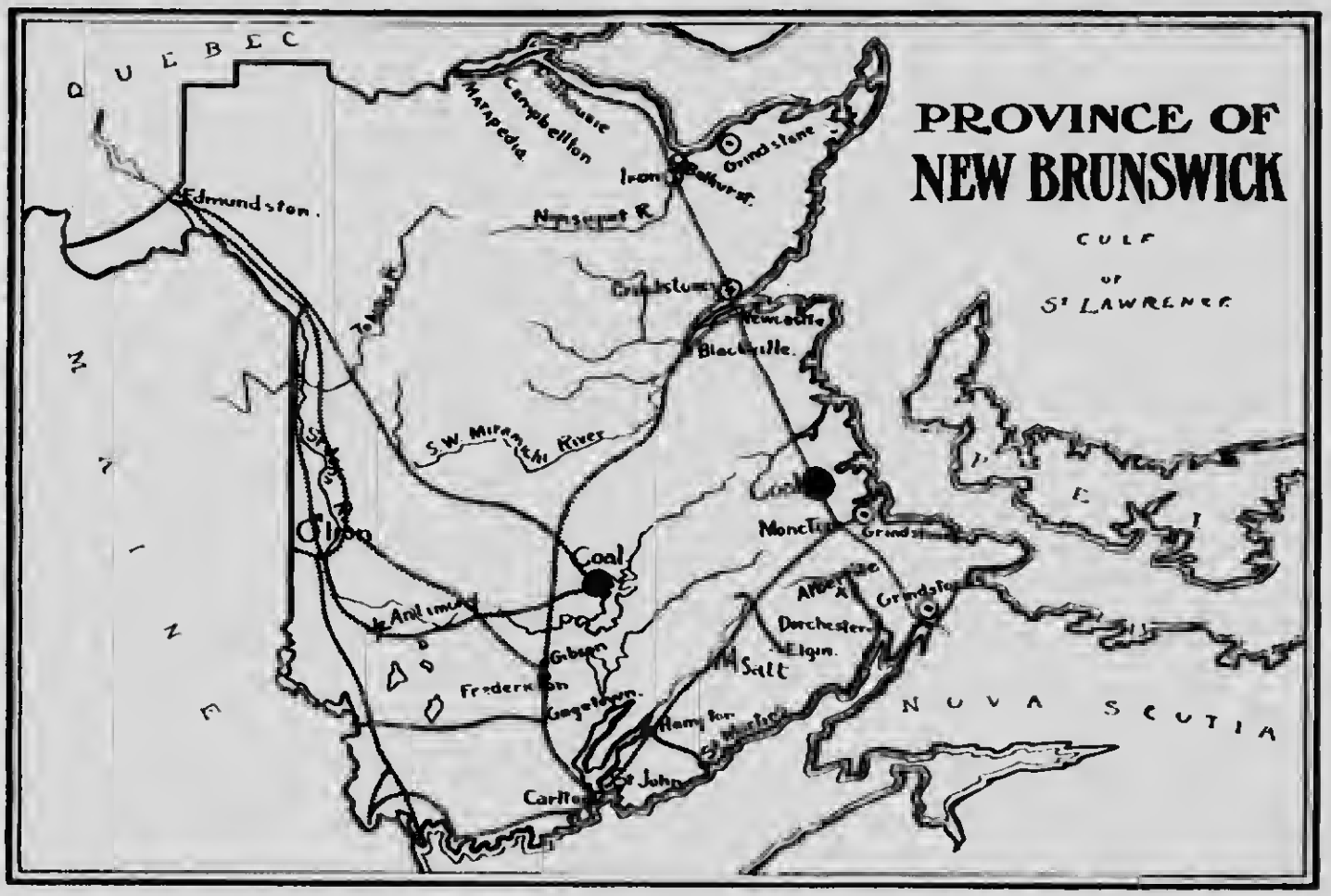
Copper, occurring as the gray sulphide disseminated through micaceous slates and altered rocks, and also found in veins, has been mined at Martin's Head, on the Bay of Fundy. A copper content of 4% to 5% was reported.

Chalcocite, impregnating conglomerates and sandstone beds, was worked for some years at Dorchester, Westmoreland County.

Large deposits of manganese ores were actively mined until recent years. Some work is still being done. The ores are remarkably rich.

Antimony suphide, stibnite, was mined from 1383 until 1890 near Fredericton. Here also the deposits were large and should have proved profitahle.

For nearly thirty years New Brunswick has shared with Nova Scotia the eastern gypsum export trade with the United States. The annual outpnt of the Province, most of which is to hs credited to the Hillsboro quarries in Albert County, exceeds 100,000 tons of the crude mineral. The gypsum


PROVINCE OF
NEW BRUNSWICK
QUEBEC
GULF
OF
ST LAWRENCE
Edmundston.
Campbellton
Grindstone
Newcastle
Blackville.
Coal
Moncton
Grindstone
Dorchester
Elgin.
Salt
Fredericton
Gagetown.
St John
NOVA SCOTIA

industries of New Brunswick and Nova Scotia are capable of great enlargement.

Graphite is mined in St. John County near the mouth of the St. John River. Though on a small scale, the operations are understood to be profitable.

Bituminous shales, grindstones, building stones, limestone, mineral waters, are the remaining mineral staples of the Province. Brick-clays are found in many places, and brick making is carried on to a considerable extent.

Albertite, no longer mined, was once a mineral of great importance in New Brunswick.

Briefly, New Brunswick is almost virgin territory to the prospector. Both metallic and non-metallic minerals are widely distributed. Travel is for the most part easy. The country is intersected by large rivers. In the north game is plentiful. Everywhere wood and water are to be had in abundance. The Province contributes but little to the mineral production of Canada. This appears to be due to anything but lack of natural resources.

Mining in Quebec.

Tho Province of Quebec forms an important portion of Canada, and, by virtue of its natural riches and transportation facilities, plays an essential part which is destined to become still greater through the industrial and economic development of that great division of the country. It is situated on both shores of the Gulf and River St. Lawrence, which are navigable by the largest vessels as far as Montreal, whose port is in turn connected by a complete system of canals with the great lakes of North America, as well as by a not less complete network of railways with all the great centres of this continent.

GEOLOGICAL SKETCH.

The geological formation comprises the great Laurentian mass to the north of the River St. Lawrence, which is the northern limit of the Silurian horizon embraced between Quebec, Montreal and Lake Champlain. A great fault, or break, in this, running in a north easterly direction, brings to the surface the Cambrian and Precambrian formations covering the Eastern Townships, and constitutes the southern limit of the Silurian.

Outside of the superficial alluvia, there are no formations more recent than the Devonian, except a small carboniferous strip on the Baie des Chaleurs.

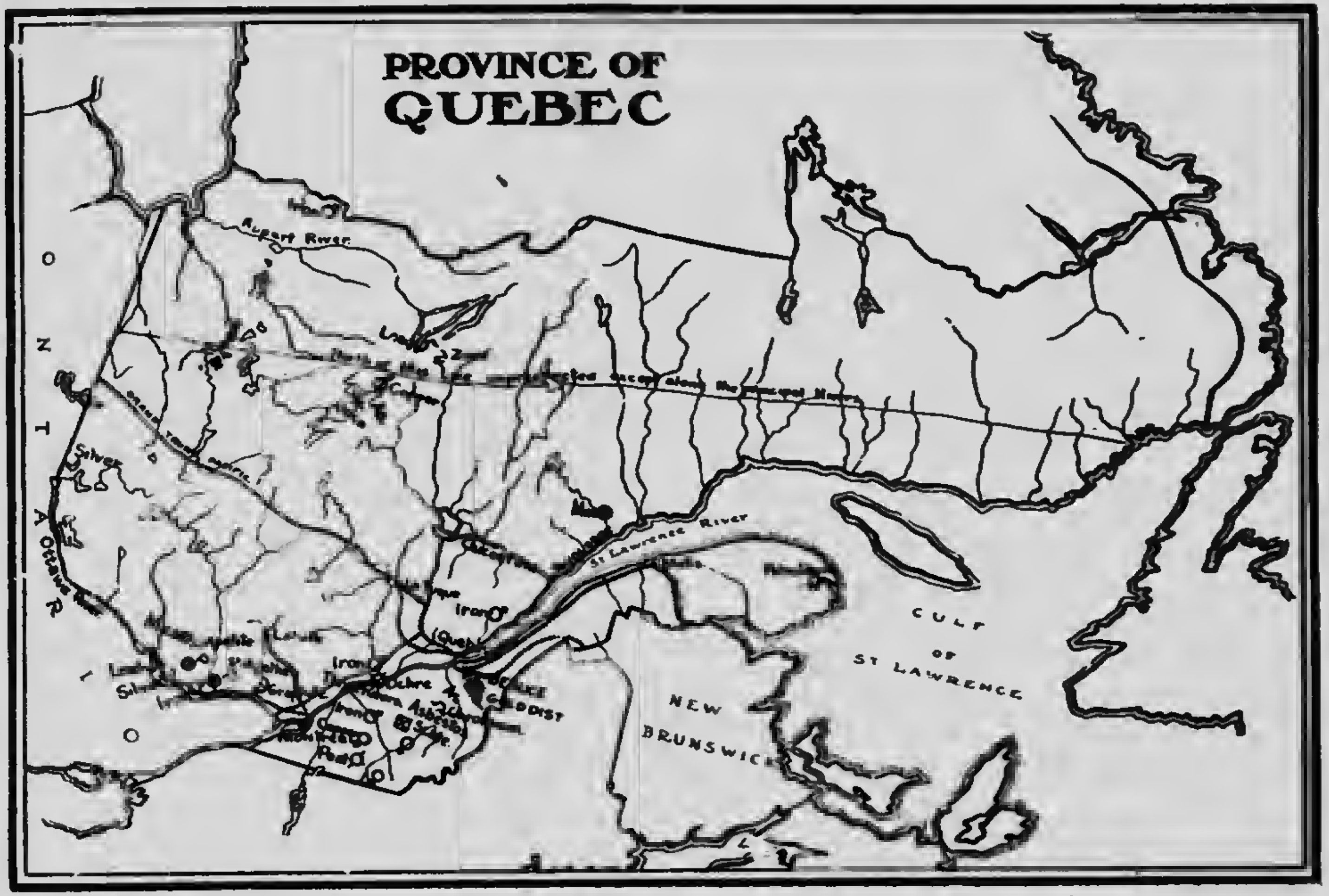
From the economic point of view, phosphate, mica, titanic iron, magnetic iron, graphite, molybdenite, are found in the Laurentian or to the north and in the higher formations, that is to say, to the south of the St. Lawrence, copper, asbestos, chromic iron, magnetic and oligist iron, while the recent alluvia show gold, bog iron, ochre, peat, etc.

No coal has been found in the province and it is not likely that any will be met with in commercial quantities, but wood fuel is abundant and there are many peat bogs still undeveloped. Further, the rivers furnish splendid water-powers which are beginning to be utilized.

Latterly, in the Northwestern Section, between the Height of Land and James Bay, a considerable development of Huronian rocks has been noted, in which there has been discovered in the neighborhood of Lake Chibogomo, asbestos, copper, auriferous quartz, iron pyrites, magnetic iron, all probably in commercial quantities. This new district will be opened up by the construction of the Grand Trunk Pacific Railway.

IRON.

Magnetic iron ore and bog ore are distributed at many points throughout the province; the oligist and hematite varieties are met with also, but in smaller quantities. Although coal has not been found in the province, the iron industry is of very early date in its history and it was probably this part of


PROVINCE OF
QUEBEC
Rupert River
ONTARIO
Ottawa River
Silver
St Lawrence River
GULF OF ST LAWRENCE
NEW BRUNSWICK
Iron
Ochre
Asbestos

Canada that saw the first furnaces in North America. In fact, it was in 1737, under the French regime, that the first furnaces, or Catalan forges, were established in it under the name of the "Forges of the St. Maurice." The ore used was bog ore and the fuel wood charcoal. This industry has been since then carried on intermittently; blast furnaces have been erected and at the present time, the Canada Iron Furnace Co. at Radnor has a blast furnace turning out twenty-five tons of pig iron per day, and still using bog ore and wood charcoal. The pig iron obtained is of superior quality and finds a ready market and a high price in the United States and in Europe. It has been employed in Canada, especially for the manufacture of railway car wheels, with the greatest success. There is another furnace using the same materials, at Drummondville, which is the property of J. McDougall & Co. The output of pig iron amounted to 8,970 long tons in 1907.

In iron metallurgy, other ventures have been undertaken with the magnetic sands at Moisic on the north shore of the St. Lawrence, and with the titanic iron at Baie St. Paul, but for certain reasons these industries did not prove lasting.

Magnetic iron has been found in the rocks in the neighborhood of Ottawa, in the counties of Ottawa and of Pontiac, and also in the Eastern Townships at Leeds and near Sherbrooke. Bog ore is found in many localities.

MAGNETIC SANDS.

The magnetic sands of the north shore of the Gulf of St. Lawrence, which form beaches extending for several miles at Moisic, the river St. John, Natashquan and other points, are worthy of special attention. These sands, deposited by natural concentration, appear to contain a practically unlimited quantity of iron of a superior quality, when freed from the titanic element which is combined with it.

In the natural state, these sands are a mixture of fine grains of quartz, feldspar, garnet and other minerals, titanic iron and magnetite, the proportion of the latter varying from 10 to 80 per cent., but a running concern operating upon them should count upon an average proportion of about 20 per cent. of a concentrate yielding the following analysis:

Moisie Sand.

Sesquioxide and protoxide of iron	96.67
Phosphorus	0.03
Sulphur	trace
Manganese	0.3
Titanium	0
Insoluble Matter	2.88
Undetermined	0.09
	100.00
Metallic Iron	70.01

The natural sand may be concentrated and practically freed from the titanium which it contains, many magnetic or electro-magnetic separators hav-

ing been invented for that purpose; but it is in too fine a state to be used in blast furnaces, and several systems of agglomerating it have been proposed, while other inventors have suggested the employment of electricity to treat directly the concentrated sands for iron or ateel.

In any casc, there is on the north shore of the St. Lawrence an abundant source of high-grade iron orea, which will aome day be utilized. The question continues to be the object of study and experiment.

TITANIC IRON.

Considerable deposits of titanic iron are found in the anorthositic rocks of the Laurentidea; the most notable being those of St. Urbain, near Baie St. Paul, of Seven Islands on the north shore, and of the valley of the Saguenay, between Lake St. John and Chicoutimi. A certain proportion of titanic iron is also mixed with the magnetic sand of the north shore.

FERRUGINOUS OCHRES.

Deposits of ferruginous ochre, yellow and brown, are met with at many points, frequently in connection with peat bogs and bog iron ores. Some of these have been worked by puddling, followed by the settling of the mud which is afterwards dried; or merely by calcining and crushing.

A great variety of industrial paints is thus obtained. At present, the centre of this industry is at St. Malo, near Three Rivers, where two companies prepare a uniform quality of calcined ochre of a brown color, their annual output being about 2,000 tons. The more important of these companies is the "Canada Paint Co.," which has its principal place of business at Montreal. Two other local Three Rivers companies, the Champlain Oxide Co. and Thomas Argall, also operate in the aame diatrict.

CHROMIC IRON.

Although long known as existing in the serpentines of the Eastern Townships, chrome iron was not worked until 1894, in the Township of Colraine, not far from the asbestos mines. As usual, this mineral occurs in irregnlar pockets in the serpentine, and is moreover of variable grade. A grade of over 50 per cent. of sesquioxide of chromium finds a ready market, while the inferior grades are more difficult to sell.

Down to 1898, the ore was hand-picked, but a certain number of depoaits could hardly be worked owing to their low grade. To-day concentrating works have been established and the development of this industry in a regular way ia now assured.

Chrome iron of high grade is employed for the manufacture of bichromates of potassium and soda, used in dyeing and the rapid tanning of leather. Within a few years the lower grades have heen used in the making of very refractory bricks for the lining of furnaces. Quantities of these have been shipped from the province to Pittsburg. It is also employed in the manufacture of alloys of iron and ateel, to which it imparts a special degree of hardness and toughness, but a very limited quantity is used for this purpose, the chemical industries and refractory products taking up the bulk of the output.

The Electric Reduction Co. of Buckingham, Quebec, manufactures ferrochrome showing over 60 per cent. of chromium, and produces several hundred tons a year out of our ores.

There are but few countries that can rival Quebec in working and shipping facilities. The line of the Quebec Central Railway runs through the mines and labor is cheap and abundant in the region. This industry, moreover, is yet in its infancy. The quantity shipped last year (1907) was only 5,721 long tons in rock and concentrates.

The ore is forwarded to the United States, to Baltimore, Philadelphia, and Pittsburg, where it sells for about $16 per ton at the mine for 50 per cent f.o.b., and for $10 to $12 for the quality in the neighborhood of 45 per cent. The United States levies no import duties.

Only a few shipments have been made to Europe but it is probable that the European market should be sought, because, notwithstanding the large quantities now produced by Turkey and especially by New Caledonia, our concentrates of uniform grade may be advantageously mixed with the ores of those countries. The average of the concentrates shipped during the past six months has been 52 per cent, some shipments having attained 54 per cent.

The operating companies are: Black Lake Chrome & Asbestos Co., Black Lake; American Chrome Co., Black Lake; Canadian Chrome Co., Thetford.

COPPER.

The Eastern Townships of the province are made up of a formation belonging to the Cambrian, certain strips of which, composed of argillaceous and talcose schists, are heavily mineralized, showing at many points important deposits of low-grade copper pyrites containing from 2 to 5 per cent. of copper, 35 to 40 per cent. of sulphur and about 1 ounce of silver per unit of copper, with occasionally a very small quantity of gold. It often happens that the percentage of copper runs up to 12 and 15 per cent. in some parts of the deposits, just as there are some deposits in which this percentage falls to 2 per cent. and less, which makes them too poor to be worked.

Towards 1864, when the price of copper ran up to over 50 cents per pound, a number of mines were opened up and worked, notwithstanding the difficulty of transportation. Important workings were undertaken, and the mines were supplied with steam machinery, concentration mills, and matte smelters.

Later, owing especially to the fall in copper, many of these mines, though still showing good indications, were shut down. A few of them, however, have been operated since and have produced great quantities of ore. At Capelton, in the vicinity of Sherbrooke, there are two American companies—the Eustis Co. and the Nichols Chemical Co.—whose regular output of ore of late years has been from 30,000 to 40,000 tons per annum. The Nicols Chemical Co. has established a sulphuric acid works, with an annex for the manufacture of chemical products.

The underground works have reached a depth of 2,400 feet and 500 men are employed in this industry. The attention of capitalists should be again drawn to the copper deposits of the Eastern Townships, which possess many advantages.

In the neighborhood of Lake Memphremagog there is a considerable deposit of low-grade ore which shows a thickness of some fifty feet on the surface and which has not yet been worked.

Besides the ores above mentioned there are also deposits of rich ores, such as chalcopyrite and bornite. The most important of these has been worked intermittently and is known under the name of the Harvey Hill Mine. In this mine there is also a little chalcocite. Native copper also has been found, but not under workable conditions.

In fine, there are still in the Eastern Townships many unopened deposits and old abandoned mines that deserve to be worked.

Good indications of high-grade copper have also been found at Matane in the Gaspé District and more recently in the north of the province in the Chibougamou region.

NICKEL AND COBALT.

At Orford, in the Eastern Townships, a little disseminated millerite has been discovered, yielding only 1 per cent. of nickel in the rock, which was deemed insufficient after some attempts to work it.

On Calumet Island, a small vein of pyrrhotite has been found, similar to the ore of Sudbury, but holding a little more cobalt. Some prospecting was done on this vein, but it is no longer worked. Quite recently in the Township of Fabre, on Lake Temiscamingue, niccolite and smaltite have been found.

LEAD, ZINC AND SILVER.

There is only a small number of galena mines in the province, in the Gaspé District, at Lake Temiscamingue, on Calumet Island and at Lake Memphremagog. Only beginnings have been made in working them. They are but little developed and contain little silver. The Calumet Island mine, however, contains a proportion of silver running up to 200 ounces per ton, but, in certain parts of the deposit, the ore turns into zinc blende.

In the Beauce region, Township of Marlow, there is a deposit of varied sulphides which carry a proportion of silver to the extent of about 80 ounces to the ton in the concentrate.

The Lake Temiscamingue mine is fitted out with a complete plant, but has been little worked.

At present none of these mines is in operation.

ANTIMONY.

This mineral occurs at only one point in the province—at Ham, County of Wolfe. The deposit consists of sulphur in which native antimony is also found, together with the accidental minerals of antimony. This mine was slightly worked some thirty years ago, and mechanical separators were put in, but it has since been abandoned.

GOLD.

About 50 miles south of Quebec, in the County of Beance, there is an auriferous region formed by the valley of the Chaudiere River. The gold found

is exclusively alluvial; its discovery dates to 50 years back, but the principal workings have been confined to the Gilbert River, where individual miners first, and then companies, have worked with succese. It ie estimated that upwards of two milions of dollare were taken out, the greater part along a distance of three milee following the valley of this river. Legal difficultiea hampered the progress of the industry. Moreover, considerable capital was required, for the former beds of the rivers have not heen traced and it would be necessary to undertake extensive prospecting before beginning to operate. The gold is generally coarse and found at a depth ranging from a few feet to 100 feet. The largest nuggets found were worth from $700 to $900. Colors are to be found in all the streama in the Chaudiere Valley over an area of 1,500 aquare miles. This region is at the same time fertile, well-populated, traversed by many good roads and in proximity to railway linee. Every year a little prospecting is done, which produces several thousands of dollars.

There are a great many quartz veins but gold in commercial quantity is not found in any of them. Throughout the whole province the precious metal is not eeen in the quartz except in some small veins near Dudswell, in the vicinity of Sherbrooke. In 1906 a little gold was discovered in the quartz in the Townehip of Marston, near Lake Megantic, upon which work is now being done.

Gold-bearing quartz has heen found in the Chibogomo District, but difficulties of transportation are retarding the development of that region.

ASBESTOS.

The Province of Quebec supplies ahout 80 per cent. of the whole world'a consumption.

When ashestos was discovered in Canada towards 1878, foreign manufacturers quickly realized its importance and the production, which at the outset only amounted to a few hundred tons a year, rose in 1888 to 4,000 tons, and in 1907 to 62,000 short tons, hesides 30,000 tone of the by-product called "asbestic," the whole representing a value at the point of shipment, near the mines, of $2,500,000. Upwards of 2,000 men find regular employment in the industry. The situation of the mines is such as to reduce the cost of transportation to a minimum. In fact, the mines of Broughton, Thetford and Black Lake, are traversed by the Quebec Central Railway, while the Danville Mine is connected with the line of the Grand Trunk by a special branch.

Two varieties of asbestos are noted: fibrous tremolite amphibole, typified by the asbestos of Italy, and chrysotile or fibrous serpentine, which is the asbestos of Canada and which ie exclusively found in the Serpentine.

Asbestos is employed alone or in combination with other textile materials, with iron or steel, indian ruhber, etc., while its lubricating qualities are increased by mixing it with talc.

Canadian aebeetoe has a density of 2.5; its color is white or greenish, bnt the aeparated fibres are white, lustrous, and silky, and were from 0 to 3 inches in length. Single threads sometimes attain a length of 5 and even 6 inches. The veins are found disseminated in every direction, without apparent regularity, in the serpentine and extend sometimes to a hundred feet and over in length. The proportion of fibre in the solid rock is variable. At the outset

of the industry, when only the fibres of ¼ or ½ an inch were utilized, a proportion of 1 per cent. to 3 per cent. of useful matter was deemed workable, while 2 per cent. was reckoned as profitable, and 3 per cent. most advantageous. Now that the whole of the fibrous matter is obtained by means of mechanical separators, this proportion attains 6 per cent., and runs up to 10 per cent. and 15 per cent., and even much more than this is utilized for the manufacture of the asbestic employed for ceiling and partition work in architecture.

Formerly asbestos was sold in the crude state, the sorting being done by hand and the useful portions separated, as far as possible, in rather expensive fashion. Moreover, there were then three classes:

1st class. Fibres, long and bright.

2nd class. Fibres, shorter.

3rd class. Fibrous debris rejected from the preceding classes.

Lastly, under the name of debris, the small residues of the hand-picking, which still contained some fibrous parts.

Since, then, matters have greatly changed and the introduction of machines to separate the fibres has necessitated two great classes: Crude asbestos and fibre.

Of the crude asbestos, the first hand-picking composed of fibres ¾ of an inch long and over is sold. This is also done with the second, which is made up of all that can be separated by hand under ¾ of an inch.

Then comes the defiberized, or machine separated, asbestos, whose qualities vary with the companies, but are generally indicated by the following classification:

Fibre, holding the largest fibres, fit for use as lining, but rarely for weaving, except in the case of extra and special qualities.

Paper Stock, containing the shortest fibres and fit to be employed in the making of paper, felts and cements.

Asbestos or crusted serpentine, which is employed for building work, and, also, mixed with lime, as coatings for boilers and steam pipes.

At the outset, the prices of asbestos was $80 for first grade. Later, this increased to $200, and even $250 in 1893, to become steadier afterwards. To-day the following prices per ton of 2,000 lbs. may be taken as the basis:

1st Crude	$200 to $250
2nd Crude	125 to 150
Fibre	40 to 100
Paper Stock	10 to 40
Asbestic	3 to 5

These prices are paid for material delivered at the railway stations near the mines, f.o.b cars, in bags of 100 lbs.

The varieties of asbestos are also known by the names of their points of production: Danville, Thetford, Black Lake, Broughton.

The following quantities in tons of 2,000 lbs. were turned out in 1907:

1st Class Crude	1,487	tons.
2nd Class Crude	2,938	"
Fibre	19,905	"
Paper Stock	37,655	"
Total	61,985	"
Asbestic	29,193	"

The asbestos mines of the Eastern Townships are worked in quarries on hills of slight elevation. These quarries do not exceed 200 feet in depth and the hoisting is done chiefly by means of cable derricks. Steam and compressed air are used and the sorting and separating shops are in the immediate vicinity of the mills and near the railway. The defiberizing mills consist of crushers, rollers, cyclone grinders, and beaters. The material goes from the crushers to shaking screens, which allow the sand to pass through, and suction fans at the extremity remove the fibre.

These mines have been in operation for thirty years and have yielded over three hundred thousand tons of asbestos, the value of which may be estimated at about fifteen million dollars.

Practically, it may be said that the quantity in sight is unlimited, and with the existing plants, the facility of obtaining cheap labor, and the ease with which shipments can be effected, hardly any competition need be feared and a bright future is in store for that industry.

The principal regions are those of Thetford, Black Lake, Broughton, with some mines in Colraine and Wolfestown and, finally, Danville.

In the Laurentides there is a kind of light yellow serpentine containing very white asbestos whose fibres are usually short. Some mines have been opened, but they are not worked at present.

Quite recently, in the Chibogomo district, in the northern section of the Province, a very extensive belt of green serpentine has been found which contains asbestos similar to that of Thetford and Black Lake. That region is at a distance of 200 miles from railways. It will therefore be necessary to build a railway to develop that district, which also contains other industrial minerals.

GRAPHITE.

Graphite is found disseminated in certain gneisses of the Laurentian formation and the chief deposits are in the Ottawa region, especially in the direction of Buckingham and Grenville. Sometimes it is found absolutely pure in small veins of two or three inches, but in too slight quantities to allow of its regular utilization in that state. The proportion of graphite disseminated through the rock is from 20 to 60 per cent., and large masses of such ore are found, but it has to be concentrated mechanically and the lightness of the graphite makes the operation a difficult one, the industrial product being far below the theoretical yield. Near Buckingham three companies have put up three mills for mechanical preparation, while a company has established itself at Calumet, in the county of Argenteuil. All of them, however, have worked very irregu-

larly. The chief use made of graphite is for the manufactnre of refractory cruciblea. There are also many special, though limited, uses. Canadian graphitc is of very good quality, but it has to compete with similar products from thc United States and the pure graphite from Ceylon, and the yearly prodnction is very slight.

The following companics arc fitted out for the preparation of industrial graphite:

The Bell Mine, Buckingham.
Diamond Graphite Co., Buckingham.
The Bnckingham Co., Buckingham.
The Calumet Mining and Milling Co., Calumet.

Phoaphate of Lime.

Green and red apatite was mined on a large scalc some fifteen years ago in the County of Ottawa, but foreign competition caused a great drop in prices and completely put an end to that industry. Powerful companies, fitted out with steam and compressed air machinery and employing large numbers of men, got out at the time 30,000 tons a year of phosphate containing a proportion of 80 per cent., but in 1907 the shipments were only 400 tons, obtained from the mica mines and for local use. Aa the chemical fertilizer industry is but little developed in Canada, a market has to be sought abroad.

At present the phosphate industry is centralized in the hands of Mr. F. Higginson, who has established a superphosphate factory at Buckingham, and who also sells a high grade phosphate for the manufacture of commercial phosphate.

MICA.

Commercial mica is known under the name of white mica (muscovite), amber mica (phlogopite), black mica (biotite). These three varieties exist in the Laurentian formation north of the St. Lawrence, but amber mica is most abnndant and is mined on an extensive scale in the Ottawa region, especially in the townships of Templeton, Hull, Portland and Wakefield.

Amber mica is chiefly found in that part of the Laurentian formation in which pyroxene predominates and which also contains important deposits of apatite. Mica, mixed with apatitc, was then considered as harmful and thrown away with the debris. Since mica has begun to be used in the electrical industry the old dumps have been worked over and all the mines where mica has been found have been reopened. Thc working of mica has thus become a real industry and several hundred men are employed in the mines, while a large number of women and children are engaged in trimming mica, either in the vicinity of the mines or in Ottawa itself, where several companies buy and sell it. The greater portion of the mica goes to the United States and the United States Government, to protect its own white mica mines, imposes a dnty of 6 cents per pound on crude mica and of 12 cents per pound on cut mica, plus 20 per cent. *ad valorem*.

At the ontset of this industry, which dates from 1890, mica was all sold cut in pieces of rectangular shape, while at present, in order to benefit by the lower duty, it is aold crude, bnt after having been thumb-trimmed, an operation con-

sisting in the removal of all parts not adhering to the crystal. It is prepared in sheets abont 1-16 of an inch thick and is classified according to size, that is, according to the dimensions of the rectangle that can be inserted in the crystal. Thus there are varieties from 1 inch by 1 inch to 5 hy 8 inches. These marks are well known in the trade, and prices vary greatly according to the dimensions. Mica is sold in barrels weighing from 350 to 400 pounds.

For white mica, 25 per cent. may be added. The quality of mica depends chiefly on the facility with which it cleaves into uniform sheets and on its flexibility. It ahould be free of cracks, holes and metallic stains; the light-coloured varieties are generally preferred when all the other conditions are realized. The qualities of mica as a non-conductor of electricity assure it a good fnture in that industry, if no other substance takes its place.

With the view of replacing the large sheets of mica, which are very expensive, aome manufacturers make sheets of a substance, called micabeston and micanite, consisting of very thin sheets of mica glued together and compressed to a thickness of less than one-sixteenth of an inch, which can then be cut to the required size.

That industry gives rise to a new kind of mica (thin split), that is, mica split into very thin sheets, which is now shipped in large quantities from Ottawa, where it is prepared for the American market.

Amber mica, in Canada, is found in the pyroxenic belts of the Laurentian formation, in pockets or accompanying veins of calcite.

In 1907 the production of mica, thumb-trimmed, alit, and rongh-culled represented an amount of $224,000.00.

Black mica had for long been thought little of, but it is now used when it cleaves well and is snfficiently flexible.

There are, in the province, some mines of white mica found in helts of pegmatite. An important mine has been worked in the township of Villeneuve (Ottawa County); one also near Murray Bay; two in the Saguenay region, and one in the northern part of the county of Berthier. It is less easy to work than amber mica and much more irregular.

MINERALS CONTAINING RADIUM.

In an old mine of white mica, near Murray Bay, Charlevoix County, a variety of uraninite (cleveite), containing radium, has been found. The mineral has a radio-activity equal to six, taking metallic uranium as the unit. In the same mine a carbonaceous substauce was found, its composition being that of bituminous coal, containing about 7 per cent. ash. The ash contained 35 per cent. of uranium. The coal itself and the ashes are also radio-active. Those specimens which are, moreover, the only minerals containing radium found so far in Canada, are found only in small quantities. Radio-active minerals have also been found in the Maisonneuve mica mine (Berthier Connty).

FELDSPAR.

Orthoclase or potash feldspar also exists in the Laurentian formation in workable deposits, in the form of thick veins of pegmatite, which are also mined sometimes for white mica, and, to a slight extent, for vitreous qnartz.

A small quantity has been got out in the County of Ottawa, but an important deposit has also been found on the Laborador coast. Low prices and a limited demand prevent the greater development of that industry. Mr. A. W. Allan, of Ottawa, is the person chiefly interested in such mines.

COMBUSTIBLE NATURAL GAS.

In the valley of the River St. Lawrence, there is an extensive formation, lying between Quebec, Montreal and th head of Lake Champlain, which belongs to the Lower Silurian and Cambro-Silurian formations, and consists of the Hudson River and Trenton limestones, and of the Utica schists. Combustible gas is found in this formation, which probably also contains petroleum. The gas issues from the soil at many points, and is even used on a small scale at some. Borings made at random have established its existence in industrial quantities, and, of late years, the Canadian Gas and Oil Company has bored wells in a more systmatic way, which have struck gas when reaching the solid rock under the surface drifts. Pipe-lines have been laid and the gas distributed to several small towns, Three Rivers amongst others.

PEAT.

Peat deposits exist practically everywhere in the province. They are not utilized, although thirty years ago, attempts were made to use peat as fuel for locomotives. The result was said to be fairly good, but it is not surprising that wood should carry the day in a forest country. Some years ago experiments were resumed for compressing peat and using it industrially, and fairly good results were obtained. In any case, that product may be looked upon as a valuable reserve for the future in a country where there is no coal and where timber will some day be exhausted.

BARITE.

Barite has been found in several places among the Laurentides but it has only been mined on a small scale in Hull.

STEATITE OR TALC.

This is better known under the name of soap stone. It is found in the great Serpentine belt of the Eastern Townships. Many deposits of it are known, but only one was worked formerly and then abandoned owing to low prices and limited demand.

MINERAL WATERS.

In the Silurian formation of the River St. Lawrence many springs of mineral water are found which issue chiefly from the Trenton limestone. These waters have been classified by the Geological Survey of Canada and some of them are highly appreciated and used on account of their medicinal properties. Among others may be cited the waters of St. Leon, Caledonia, Abenakis, Radnor, etc., which from the foundation of a regular trade.

PRECIOUS STONES AND RARE EARTHS.

In the Laurentian rocks a great variety of gems are found which, in some cases, have been cut and used for jewelry, amongst others: colored tourmalines, opalescent feldspar, asteriated quartz, garnets, etc.

In the same formation are many crystallized minerals, sought after for collections.

LABOUR AND MISCELLANEOUS.

The average day's wage for an ordiuary lahorer is $1.25; for miners, engineers, carpenters and hlacksmiths, $1.50 to $1.75; for foremen, $2.00 to $2.50; for two-horse teams with driver, $3.00 to $4.00.

The day's work is ten hours and lahour ia plentiful.

During the winter season, which lasts from Novemher to April, mining can he carried on and conveyance hy winter vehicles is then easier and cheaper. Fire wood costs from $2.00 to $3.00 per cord of three feet, coal from Nova Scotia costs from $5.00 to $6.00, delivered. Electric power supplied by the numerous water-powers in the province, is heginning to he used at a cost of from $20.00 to $30.00 per horse-power per annum.

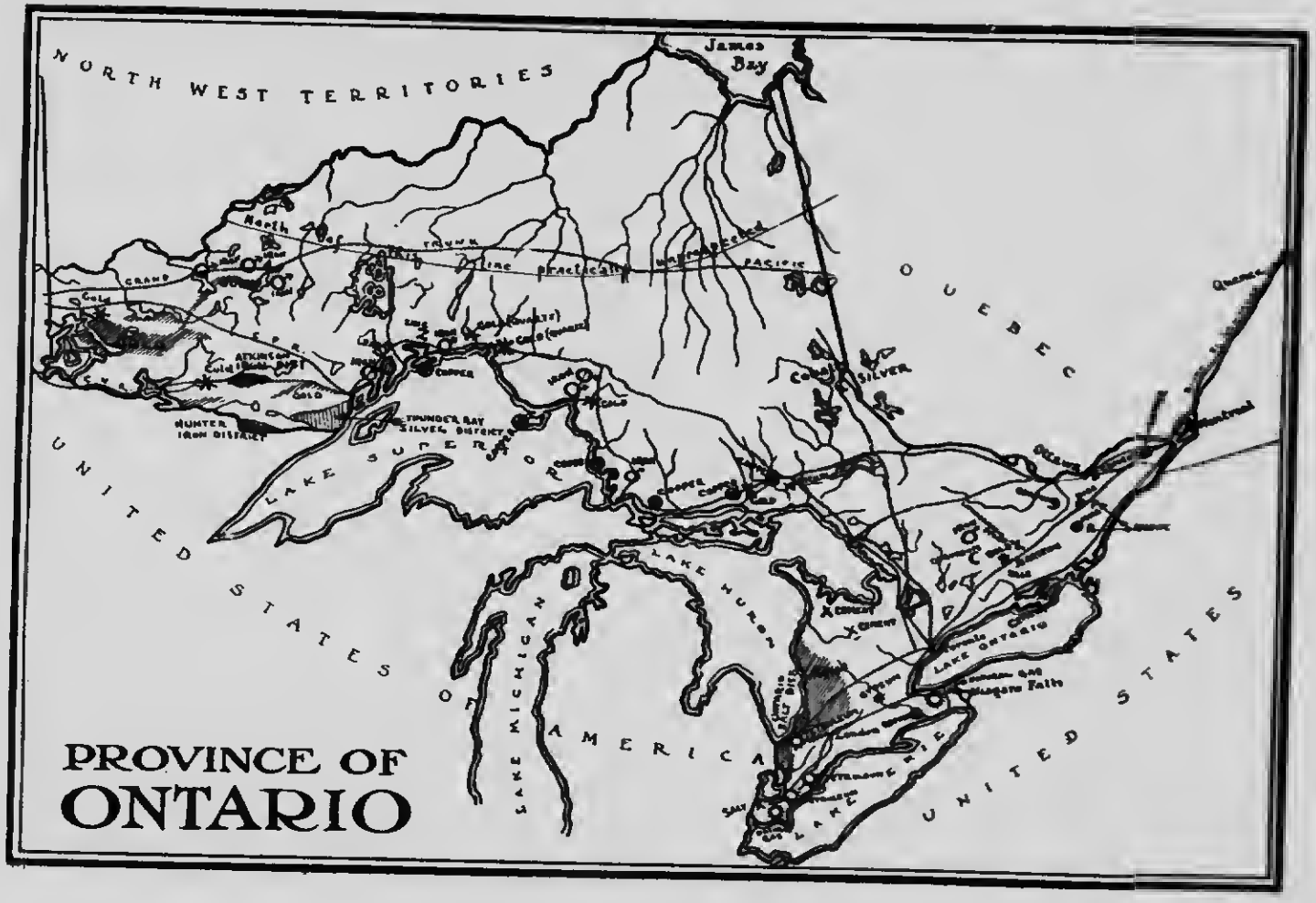
LEGISLATION.

The mines helong to the government of the Province on all unsold lands and on agricultural lands sold since 1880, hut, in all cases, gold and silver are always reserved, whatever may he the date when the land was sold.

The Government grants prospecting licenses, giving the holders the first right to huy mines. In the case of lands whose surface owned hy others, expropriation is resorted to if an amicahle settlement is found to he impossible. Mines, when discovered, may he purchased or leased from the Government. The price, if sold, is from $2.00 to $20.00 per acre, according to the nature of the minerals and their proximity to railway lines, the minimum sold to any one person heing 100 acres, the maximum, 400, and in special cases 1,000 acres. Mining lands may also be leased for $1.00 per acre per annum, the maximum rented being 200 acres. Such mining licenses are for one year only, hnt are renewahle and transferahle

Annual Mineral Production in the Province of Quebec (as puhlished hy the Bureau of Mines, Quebec).

Year.	Value.	Year.	Value.
1889	$2,266,660	1899	$1,093,272
1890	Not given	1900	1,276,076
1891	"	1901	2,997,731
1892	"	1902	2,985,463
1893	"	1903	2,772,762
1894	"	1904	3,023,568
1895	"	1905	3,750,300
1896	"	1906	5,019,932
1897	1,466,920	1907	5,391,368
1898	1,673,337		


NORTH WEST TERRITORIES
James Bay
QUEBEC
UNITED STATES OF AMERICA
UNITED STATES
LAKE SUPERIOR
LAKE MICHIGAN
LAKE HURON
LAKE ONTARIO
LAKE ERIE
PROVINCE OF
ONTARIO

Ontario.

The mineral wealth of Ontario is extensive and varied. Much has been brought to light in the older parts of the Province, and as exploration pushes forward into the newer regions and railways are built through the forests, new mineral-bearing tracts are discovered and undreamed-of resources revealed.

The history of railway building in Ontario during the last couple of decades runs parallel with the discovery of new and important mineral fields. For instance, in the early eighties the Canadian Pacific Railway was being laid down to bind together the east and the west. In cutting through the rocks west of Lake Nipissing, rich copper deposits were encountered, which a little later were found to be still more valuable for nickel; and ere long the nickel mines of the now famous Sudbury District were in operation, which produce the lion's share of the world's supply of that metal. Again, in 1903 the Government of the day, desiring to connect the older parts of Ontario with the new, projected the Temiskaming & Northern Ontario railway from North Bay towards the northern inland sea. During the construction of this railway the silver veins of Cobalt were discovered, the first finds being within a few yards of the right of way. This was one of the notable mining discoveries in North America, taking rank with the gold of the Yukon, the copper of Arizona, and the silver of Colorado.

To rear an imposing fabric of industrial civilization the basic necessity is iron ore. All other industries depend upon the iron industry. Eastern Ontario abounds in magnetic ore; some of it of Bessemer quality, but much of it of lower grade, though capable of utilization by concentrating and purifying processes. In Northern Ontario there is an immense extent of iron formation, parts of which have yielded large bodies of workable ore, such as the Helen, Moose Mountain and Atikokan mines. There are many more known localities where the ore bodies on the surface are low in iron, and where more systematic and costly search by the diamond drill will be required to detect the presence of merchantable ore beds. The smelting half of the iron industry is already on the ground in Ontario. The blast furnaces are located on the great lakes, at Hamilton, Midland, Deseronto, Sault Ste. Marie and Port Arthur, where they are well situated for receiving supplies of both ore and coke. Up to the present they have been using, for the most part, imported ore, but the supply of the domestic is gradually increasing and may shortly be expected to displace, partly at least, ore from the other side.

In the metals, the products distinctively characteristic of the Province are nickel and silver. The Canadian Copper Company and the Mond Nickel Company have for years been at work on the southern range and are producing altogether about 10,000 tons of nickel and 7,000 tons of copper per annum in the

form of nickel-copper matte. There are large reserves of nickel ore on the northern range which have not yet been exploited, but the extension of shipping facilities afforded by the branch of the Canadian Northern to the Moose Mountain Iron Mine will also give an outlet for the nickel ores of the Northern range. The only other important source of nickel in the world is the Island of New Caledonia, but this has been much surpassed in late years in extent and value of output by the Sudbury region.

The silver mines of Cobalt have given Ontario a high place as a silver producing community. Only three States of the Union, namely, Colorado, Montana and Utah, produced more silver in 1907 than Ontario, whose mines last year contributed between 6 and 7 per cent. of the entire product of the world. The yield in 1908 will doubtless be greater than in 1907, and may reach a total value of $8,000,000. The Cobalt district does not contain all the silver of north-eastern Ontario. A new camp is being opened up south of Lorrain township on the shore of Lake Temiskaming, and another up the Montreal River in the township of James, and on Silver, Anvil and Bloom Lakes. In all these regions, as at Cobalt, the ore carries in addition to silver, cobalt, nickel and arsenic,—a unique combination in North America.

Copper is found not only associated with the nickel of Sudbury, but as sulphide on the north shore of Lake Huron and elsewhere. The recent fall in the price of copper has had a discouraging effect upon the production of this metal, especially from non-nickeliferous ore, but there is little doubt that the region lying between the main line of the C.P.R. and the Soo branch will yet be the scene of an active and extensive copper industry.

In the non-metallic list of materials, Ontario alone of all the Provinces produces petroleum. This is found in the southwestern peninsula, in Lambton, Essex and Kent counties, which last year yielded upwards of 27,000,000 imperial gallons of crude petroleum. The large advance on the previous year's production is accounted for by the yield of the new Tilbury and Romney fields.

Natural gas, too, is being produced in largely increased quantities. The value of the production in 1907 was about $750,000, the output having doubled in value during the last two years.

Salt exists in inexhaustible quantities in the Onondago rocks on the east shore of Lake Huron and St. Clair. Comparatively speaking, only a small amount is raised each year, the production of 1907 being about $430,000 in value.

In eastern Ontario the best quality of mica for electrical purposes is produced in considerable quantities. This is the amber variety, which is flexible, tough, and impervious to the electric current.

Corundum, too, is found in large deposits in the counties of Renfrew and Hastings, and this useful abrasive is produced in large quantities. These counties contain the largest bodies of corundum in North America.

Other products are iron pyrites, used in the manufacture of sulphuric acid, and raised in considerabel amounts in Hastings county, at Rib Lake and at the Helen iron mine; feldspar, used in the manufacture of pottery and enamel ware, which is quarried from the huge deposits on the Kingston and Pembroke railway; talc, for the grinding of which a mill is being constructed at Madoc;

and graphite, of which there are large deposits on the Rideau canal and in Renfrew county and elsewhere.

In building materials, Ontario is unusually rich. Brick clay is found distributed throughout the whole of the southern part of the Province, and in some parts in the north. Limestone is equally abundant; and various kinds of granite, sandstone, limestone, etc., can be quarried in numerous localities. Materials for the production of Portland Cement also abound. Marl is found in many parts of older Ontario, and there are deposits of limestone which can be used for the same purpose. The output of Portland Cement has increased year by year until the production of 1907 was about 1,900,000 barrels.

Ontario has hitherto been regarded by many as a Province well adapted for agriculture; its forests have been spoken of as inexhaustable; and its fisheries in the great lakes have been productive and valuable. But Ontario has now taken the first rank among the confederated Provinces in the mining industry, and to all appearances possesses resources that will enable her to maintain and improve her present position.

Nine years ago these mineral products that are classified as metallic constituted only 45 per cent. of Ontario's whole production; to-day they amount to more than 60 per cent. of the total mineral production. During the same period the output of both metallic and non-metallic products has increased steadily and largely. In six years the official returns show an increase of 84 per cent.

While the silver output of Cobalt has been a factor in this growth, it is by no means responsible for all of it. Such basic industries as iron and copper smelting, the manufacture of brick and cement, have expanded with even greater rapidity than is indicated by the advance of the mineral industries generally.

This fact accentuates the stability of Ontario's position as a mineral producer. Another striking evidence of the variety of the Province's resources is the consideration that since 1895 there have been added to the list of outputs, ten metallic and eight non-metallic substances.

The land area of Ontario is, roughly, about 220,000 square miles, or approximately twice as large as Great Britain. The southern and eastern portions are more thickly populated than are the northern and western. The former sections, underlain by sedimentary fossiliferous rocks of Palaeozoic age, are fertile and extensively cultivated. They occupy hardly one-fifth of the province. From this settled region came the greater part of the structural material, the petroleum, natural gas, and salt.

The northern and western portions of Ontario, and into this category falls more than four-fifths of the province, are largely made up of gneissic and granitic Laurentian rocks, throughout which are areas of schists, diorites, etc., of the Huronian system, constituting the chief metallic mineral bearing districts. Here are found the gold, silver, nickel, copper, cobalt, iron and other metallic ores.

Even far north towards James Bay, large tracts of the north country are well adapted to agriculture. Timber and pulp-wood exist over enormous areas and the whole country is interseeted by large rivers and dotted with

lakes. An incalculable total of energy is waiting to be harnessed in the falls and rapids of these rivers.

But, in spite of the wealth of forest and stream, the north country's future is dependent upon the discovery of new mineral deposits.

Even before the discovery of Cobalt, northern Ontario was believed to be a region of great possibilities. Since that event belief has been strengthened, possibilities have become actualities, and the prospectors' zone of operations has been enlarged indefinitely.

Another most important factor in the development of Ontario's mineral wealth has been the intelligent assistance freely offered to the public by the Ontario Bureau of Mines, not only by means of its publications, but also in the form of summer classes for prospectors. It must also be mentioned that the personal influence of the Bureau officials has had a strong and beneficial effect upon mining operations.

Along with the beneficent influence exercised by the Ontario Bureau fairness demands that credit must be given the Canadian Geological Survey, whose efforts, extending over half a century, have always made for the healthy development of the country.

General conditions in Ontario are favorable to the permanence and growth of the mining industry. The mining laws, while open to incidental objections, are carefully constructed and honestly applied. A tax of 2 per cent. on the net annual profits in excess of $10,000, resulting from the operation of any mining venture, is imposed.

In the older mining fields transportation facilities are, of course, excellent. New lines are being laid and projected.

IRON.

About the year 1800 an unsuccessful attempt was made to operate an iron smelter in the County of Leeds at Gananoque River falls. Later, in 1813, an Englishman named John Mason, erected a furnace in the shore of Lake Erie at the mouth of Potter's Creek in the Township of Charlottetown. In operation it proved a failure. But in 1822, Joseph Van Norman and Messrs. Hiram Capron and George Tilson, who had meanwhile bought the concern, put it in blast. The furnace was kept in commission profitably until 1847, when owing to scarcity of ore and fuel, it was shut down. The iron produced at this furnace was made directly into merchantable castings.

Another blast furnace was built on the Crow River in Marmora Township in 1820, to smelt the magnetic ores at Blairton. This attempt was not profitable and, in 1828, the principal creditor, the Hon. Peter McGill, of Montreal, who had taken over the concern, asked the provincial legislature for a loan of £10,000 to carry it on. No assistance, however, was granted, and the business was conducted at a heavy loss until, in 1847, Mr. Van Norman, was induced to purchase the property for $21,000. Again the furnace was started in the summer of 1848. The pig iron was carted to Belloville, over bad roads, a

distance of 32 miles. Water transportation was later arranged over Rice Lake and the iron sold for $35.00 per ton.

But after the opening of the St. Lawrence Canals, competition with foreign pig iron, which could be sold at $16 per ton, made continued production impossible.

Several abortive efforts were made in succeeding years to run the Marmora works, but all proved failures, including an experiment in 1875, in which petroleum was used as fuel.

At Madoc, in Hastings County, Mr. Uriah Seymour erected a charcoal blast furnace about the year 1837. Owing to primitive methods and insufficient capital, failure was again the result. An interesting feature of Mr. Seymour's experimenta was the production of good pig iron with uncharred wood alone as fuel.

Another unfortunate venture of the indomitable Mr. Van Norman at Hamilton, where in 1854 he erected another furnace, brought his long business career to an end.

In 1882 an American firm, Messrs. Parry and Mills, began building a charcoal blast furnace on Burnt River, in the County of Haliburton. Lack of funds prevented the completion of the plant and no pig iron was produced.

Failures such as these did not, however, permanently discourage the iron industry in Ontario. A Royal Commission, appointed in 1888, to enquire into and report upon the mineral resources of the province, submitted a report in 1890 that had much to do with awakening the public to a sense of the possibilities of the iron industry in Ontario.

The Hamilton Blast Furnace Company (now the Hamilton Steel and Iron Company, Limited), blew in a coke furnace in 1896. Another was built in 1907. In 1899 the charcoal furnace of the Deseronto Iron Company, Limited, was put in blast. Both of these furnaces have been in commission, with slight interruptions, ever since those dates. The Deseronto furnace has recently been remodelled and now coke is used instead of charcoal. The Canada Iron Furnace Company put their Midland coke furnace in commission in 1900. The largest single plant was completed in 1902, by the Lake Superior Corporation, at Sault Ste. Marie, where two blast furnaces were erected. The operating company is the Algoma Steel Company, Limited.

The latest addition to the list is the blast-furnace of the Atikokan Iron Company, Limited, at Port Arthur, Thunder Bay District.

At Sault Ste. Marie ore from the Lake Superior ranges is used almost entirely. The company owns and operates the Helen iron mine, 135 miles to the north, but uses only a small amount of the ore from that mine. Helen ore is sold to other consumers and exchanged for Lake Superior ores. The furnaces have a capacity of about 250 tons each per day. A large and complete steel plant is operated here also.

The Hamilton furnaces use Lake Superior hematite and Ontario hematite and magnetite. They have a rated capacity of about 300 tons per day. A steel plant is run by the same company.

About 30 per cent. of the ore used at the Midland stack is Canadian. The balance is purchased from Lake Superior producers. An increasing quantity of Ontario ore is to be used here, however, the Canada Iron Furnace Company

having recently leased the Bessemer iron mina at Bessemer, Hastings County. Helen ore also is used here. Tbe daily output of the furnace is about 140 tons.

The Deseronto Iron Company uscs imported Lake Superior ores and local magnetitea and hematites.

At the plant of tha Atikokan Iron Company exclusivcly Canadian ore, mined at the Company's own mines near Port Arthur, is used.

Coke is imported from the United States for all tbese plants except in tha case of the Atikokan Iron Company, who make their own coke from imported coal.

DIMENSIONS OF BLAST FURNACES OPERATED IN ONTARIO.

	Height of Stack.	Diam. of Bosh.	Diam. of Hearth.
Algoma Steel Co., No. 1.....	70 ft.	17 ft.	11 ft.
No. 2.....	80 ft.	17 ft.	10 ft. 8 in.
Hamilton Steel & Iron Co., Furnace A.	80 ft.	16 ft.	
Furnace B.	80 ft.	20 ft.	
Canada Iron Furnace Co.....	65 ft.	13 ft.	
Deseronto Iron Co.		10 ft. 6 in.	
Atikokan Iron Co.	74 ft. 3 in.	14 ft.	

That the iron and steel industries of Ontario will expand is certain. Modern methods of magnetic cobbing and concentration will render many known deposits of iron ore amenable to treatment. Larga belts of iron-bearing territory are yet unprospected. In fact the principal need of tbe province is systematic exploitation of discovered ore-bodies and equally aystematic proapecting of new territory.

GOLD.

Tha existence of gold-bearing veins in different parts of Ontario was known 40 years ago. After the gold excitement in Hastings County in the early seventies, the Gatling mine was worked for some years, and bas been operated intermittently since then. Tbe district lying between Port Artbur and the Manitoba boundary was later the scene of several considerable discoveries, tha first of which was made on Hay Island, in the Lake of the Woods. Early in 1899 this western region became the centre of much activity. Numerous diacoveries of gold-bearing ores were also made in the Micbipicoten diatrict, northb-east of Lake Superior.

It would be impossible bere to do more than mention tha general development of the gold-mining industry. But, ten years ago, Ontario gold-mining loomed large in the public eye.

In the western districts nearly all the gold-ores are free milling; but in the Hastings areas, to the east, while free-milling ores are ancountered, the orea ara uaually beavily impregnated with arsenical, iron, and copper pyrites.

The gold-bearing veins of Ontario are usually of moderata width althongh soma large ore bodies bave been opened up. At present gold-mining is more active tban it bas heen for some years. In tbe earlier days difficult transpor-

tation, and crude mining and milling methods militated against contiuuous and profitable operations.

The boom in the Lake of the Woods and other western districts, flickered and died. The eastern gold mines operated sporadically, until, in 1906, most of the mines were idle and only 3,926 ounces of bullion were obtained from eight working properties, situated in Northwestern Ontario and the Sudbury and North Shore districts.

There are now, however, indications of a revival of gold-mining. Development is active in and around the Wabigoon district in the North West, the gold-arsenic veins of Hastings are being worked once more, and Larder Lake 34 miles north of the head of Lake Temiskaming, is showing on one property at least, unexpectedly rich ore.

LEAD.

Deposits of galena, all of which are silver-bearing, have been opened up in many parts of Ontario. Many years ago a smelter was in operation at Kingston, using the ore from the Frontenac mine. A small smelter also was built and worked at the Ramsay lead mine, near Carleton Place, County of Lanark, but with no degree of success.

Of late years the Stanley Smelting Company took over and worked the Hollandia mine in Hasting County, and the Frontenac mine mentioned above, and produced some thousands of tons of pig lead. Financial trouble has stopped the enterprise.

Lead-smelting, however, could and should be carried on profitably in Ontario. Heretofore, the economic importance of the position of the smelter in relation to its supplies of ore, etc., has hardly been given due consideration.

ZINC.

Although several payable deposits of zinc blende have been discovered, on only two or three have much work been done. At the Richardson (or Olden) mine a concentrating plant was built and ore has there been mined and treated for several years.

SILVER.

The history of silver-mining in Ontario is worthy of aeveral volumes. The spectactular discoveries of silver at Silver Islet, Northern Lake Superior, in 1868, and the equally sensational Cobalt discoveries in 1903-4, attracted world-wide attention. We shall glance hurriedly over the salient points of both districts.

Lake Superior Silver Mining.—The Port Arthur district, extending roughly from Thunder Cape and Silver Islet to Whitefish Lake, is composed largely of black shales, cherts, and dolomites resting unconformably on the Huronian, and capped in large areas by great overflows of trap. Numerous veins occur, cutting the various series of rocks and sometimes crossing intrusive vertical dikes. The vein matter is usually made up of calcite, quartz, fluorspar, heavy spar, and brecciated wall-rock. The metallic minerals found are iron pyrites,

galena, zinchblende, argentite, and native silver. The cobalt, nickel, arsenic minerals found in the Cobalt region also occur here, but in much amaller quantity.

The native silver is found in grains, threads, and amall and large branching masses; the argentite in leaves, and small massea, but also in large crystalline lumps.

The first notable discovery of silver on Lake Superior was made by Mr. Peter McKellar in the autumn of 1866, at what afterward became the Tbunder Bay mine.

The Shuniah vein, diacovered by Messrs. John McKellar and George A. McVicar in May, 1867, was worked by the Duncan Mining Company. The vein was 25 feet wide, and was composed of quartz and calcite. It was not found to be payable.

Mr. Thomas McFarlane, a geologist employed by the Montreal Mining Company to survey their locations on Lake Superior, came upon Silver Islet. Mr. McFarlane took out $1,500 worth of silver with one or two shots and sent it to Montreal. Nothing was done, however, until in 1870, the property passed into the handa of the Ontario Mineral Land Company, who worked the mine until 1884, when a depth of 1,230 feet had been reached and ailver to the value of $3,250,000 extracted. The market price of silver was then considerably more than one dollar per ounce.

In 1882 silver-bearing veins were discovered and worked in the Rabbit and Silver Mountain districts. The Beaver, the Badger, tbe Rabbit Mountain and the West End Silver Mountain miues were the most prominent producers.

No ailver was produced in the Province from 1892 to 1898. Operations were then resumed at two or tbree mines.

At present the historic West End Silver Mountain and several amaller mines are running.

Conditious have altered so radically and so rapidly aince the early days of Lake Superior silver mining that failures of yesterday might easily be auccesses of to-day.

Cobalt District.—Discovered in 1903, Cobalt camp has grown until now its monthly production of silver is worth nearly two-thirds of a million dollars. It has passed successfully through the boom and promotion stages, and ia now a mining camp in tbe true meaning of the phrase.

Cohalt has been described ao often and from so many points of view in tecbnical periodicals and in official reports that it is totally unnecessary to duplicate here what is eaaily available to any person intereated. It may be noted, however, that the productive area in the country surrounding Cobalt is constantly widening. Moreover, ore-treatment problems are being aolved; transportation is being cbeapened, and market conditions are much better understood.

Dr. W. G. Miller's monographs, included in the official reports of the Ontario Bureau of Mines, are the most complete and accurate aources of information, geological and general, touching on Cobalt.

Cobalt, beside being a prodncer of silver, is a aource of cobalt, nickel, arsenic and biamutb.

COPPER AND NICKEL.

The nickel-copper ores of the Sudhury district and the geology of the region have been most adequately described and diacussed by Dr. A. E. Barlow in a monograph written for the Geological Survey of Canada, and by Dr. A. P. Coleman in the Annual Report of the Ontario Bureau of Mines, A fnll description of the equipment of the Canadiau Copper Company mines, written by Mr. D. H. Browne, chief metallurgist to the company, may he found in the Canadian Mining Journal, Auguat 1st, 1907.

The following were the aggregate resulis of the operations on the nickel-copper deposits of Ontario in 1906 and 1907:—

		1906	1907
Ore mined		343,814	351,916
Ore smelted		340,059	359,076
Bessemer matte produced		20,364	22,041
Bessemer matte shipped		20,310	22,025
Copper contents of matte shipped		5,265	6,996
Nickel contents of matte shipped		10,745	10,095
Spot value of matte shipped		$4,628,011	$3,289,382
Wages paid		1,117,420	1,278,694
Men employed	Number	1,417	1,660

Annual Mineral Production in the Province of Ontario (as published by the Bureau of Mines, Ontario).

Year.	Value.	Year.	Value.
1891	$4,705,673	1900	$9,298,624
1892	5,374,139	1901	11,831,086
1893	6,120,743	1902	13,391,634
1894	6,086,758	1903	12,870,593
1895	5,170,138	1904	11,572,647
1896	5,235,003	1905	17,854,296
1897	3,899,821	1906	22,388,383
1898	7,235,877	1907	24,949,475
1899	8,416,673		

Alberta.

The Province of Alberta is fast taking her place as a coal producer. The output for the last three years indicates the growth of coal mining:—

1905	811,228	tons
1906	1,385,000	"
1907	1,534,001	"

The output of 1906 was classified thus:

Lignite coal	602,780	tons
Bituminous coal	546,623	"
Anthracite coal	235,597	"
Coal used in coke production	103,936	"
Coke produced	69,844	"

In the same year there were 61 mines in operation, of which 16 had been opened within the year.

The Pacific Coal Company at Bankhead, the International Coal and Coke Company at Coleman, the Canadian American Coal and Coke Company at Frank, the Hillcrest Coal and Coke Company at Hillcrest, the West Canadian Collieries at Blairmore, the Breckenridge and Lund Coal Company at Lundbreck, the Canada West Coal and Coke Company at Taber, and the Alberta Railway and Irrigation Company at Lethbridge are the principal operating concerns.

The coal seams range from 3 feet to 15 feet. Safety lamps are in general use. A good system of inspection is carried on by the Provincial Government.

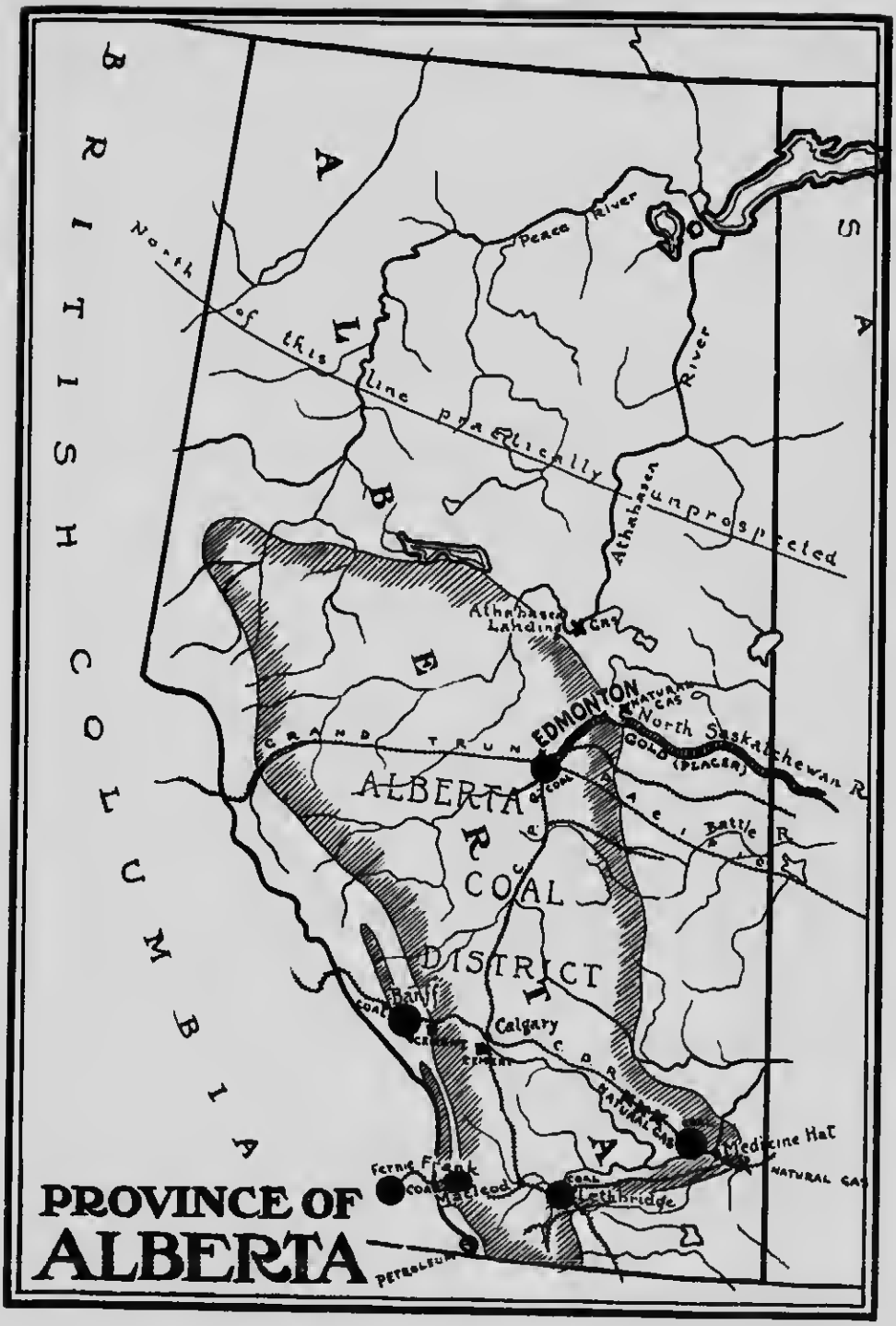
Coke for the smelters of south-eastern British Columbia is made at Coleman by the International Coal and Coke Company, which is one of their chief sources of supply. At the Lille mine of the West Canadian Collieries, six miles north of Frank, a battery of Bernard ovens is in commission.

Most of the companies mentioned above have completed or are completing elaborate modern overground equipments.

Climatic and labour conditions are good in Alberta. Coal miner's wages range from $3.50 per day for fire-bosses and special classes of miners to $2.50 for drivers, helpers, loaders, etc.

Natural gas has been found near Medicine Hat, Calgary, and Edmonton. Oil has been prospected for with some slight success in the southern part of the Province.

The Province of Saskatchewan produced 153,914 tons of coal in 1907. Much of this is lignite.


BRITISH COLUMBIA
ALBERTA
SASK
North of this line practically unprospected
Peace River
Athabasca River
Athabasca Landing
EDMONTON
NATURAL GAS
North Saskatchewan R
GOLD (PLACES)
GRAND TRUNK
ALBERTA
COAL
DISTRICT
Battle R
Banff
COAL
Calgary
C.P.R.
NATURAL GAS
Medicine Hat
NATURAL GAS
Fernie
Frank
COAL
Macleod
COAL
Lethbridge
PETROLEUM
PROVINCE OF
ALBERTA

British Columbia.

British Columbia has an area of 383,000 square miles. Within its boundaries ores of gold, silver, copper, lead zinc, and irou are found. Coal is mined extensively in the extreme east and west of the province. A measure of the growth of its mineral industry is afforded by comparing the total value of tho mineral output of 1890 with that of the past year. The returns for 1890 give a total of $2,608,803; for 1907 the corresponding figures are $25,882,560. These returns give, in brief, the history of mining and metallurgy iu British Columbia during the past 17 years—a record of constant growth and progress. With the exception of the year 1901, when the output was abuormally high, each year's production has been steadily greater than that of its predecessor.

Between 1820 and 1825 a botauist named Douglas discovered the Blue Bell mine (silver-lead) on Kootenay Lake. Coal was discovered at Fort Rupert, Vancouver Island, in 1835, but, after being opened by the Hudson's Bay Company, these deposits were abandoned in 1851, and the Nanaimo seams, also on Vancouver Island, were worked. The Nanaimo collieries produced coal from that date on to the present.

Small finds of gold on Vancouver Islaud and Queen Charlotte Island attracted some attention between 1850 and 1857; but these bore no fruit. Nor were subsequent rumours of discoveries on the Skeena River and at other places confirmed.

But between 1855 and 1857 discoveries of placer gold were made on tbe Thompson, Fraser and Columbia Rivers. Thousands of prospectors and camp followers rushed from all quarters to the Fraser. In 1858 a yield of placer gold worth $705,000 was obtained. Iu 1863 this had risen to nearly four million dollars.

Meanwhile, 1861, Williams and Lightening Creeks and other rich creeks in Cariboo were discovered. One claim on Williams Creek gave a maximum daily yield of $6,544. Other even higher yields are recorded.

The northerly gold fields of tlie Omeniea and Cassiar districts were discovered in 1869 and 1874 respectively, and temporarily brought up the decreasing aunual yield of the province. A substantial increase duriug the period 1899-1904 has been followed by a slight falling off in the last three years.

The construction of the Canadian Pacific Railway opened up the southern part of tbe province. Lode mining may be said to havo begun at about the same time (1886) that trains commenced to run regularly between the Atlantic and Pacific coasts of Canada. In the West Kootenay district valuable discoveries of ores were made in this year. Branch lines of railway were at once constructed, and steamer service was established on the lakes and rivers. Tbe East Kootenay district, various parts of the Yale district, and several

PROVINCE OF BRITISH COLUMBIA

regions on the coast also came into prominence. By the year 1894 the production of lode mines exceeded in value the total yield of placer gold.

Meanwhile coal was assuming a growingly important position. Prior to 1898 the Vancouver Island collieries produced all the coal mined in the province. In that year the Crow's Nest Pass began to produce. The erection and operation of coke ovens by the Crow's Nest Pass Coal Company at Fernie has brought up the output of that commodity to the considerable annual amount of 222,913 tons.

In the near future British Columbia will produce much more coal. New collieries are about to be operated at Hosmer in the south-east, in Nicola Valley, and on Vancouver Island. The Cassiar District also will make large contributions.

With this brief foreword, we shall glance over the different branches of the mining industry.

COAL.

Whilst there is soon to be a number of additions to the list of producing collieries, there are large coal-bearing areas in British Columbia that cannot be developed until transportation facilities have been provided. These will receive more specific mention later on.

The producing coal mines during 1907 were: The Crow's Nest Pass collieries in the Rocky Mountain coal field, in the south-eastern section of the province; the Western Fuel Company's collieries at Nanaimo, on Vancouver Island; the Wellington Colliery Company's mines at Extension and Comox on the same island, and the Middlesboro Colliery in the Nicola Valley.

The Crow's Nest Pass Coal Company, incorporated in 1897 with an authorized capital of $3,500,000, owns in fee simple about 250,000 acres of land in the Crow's Nest district. Its holdings include a large area of coal lands on the east side of Elk River, one of the streams draining East Kootenay. Operations were started in 1897, and railway connections completed late in 1898. The Coal Creek Colliery, the first opened, is about five miles east of Fernie, a vigourous town that has grown up with the Company. Other mines at Michel, 23 miles to the north, and at Morrisey Creek, 13 miles south, were opened later.

At Coal Creek colliery there are four seams, the largest of which is 30 feet wide. Six mines are working here. At Michel four mines were in operation during 1907. Here there are eight seams. At Morrisey Creek (Carbonado colliery) the mines, which were idle for a time, are being opened up again. There are here five seams.

Both "pillar and stall" and "long-wall" methods of mining are in vogue. There is main haulage both by electric locomotives and by the main-and-tail rops. Secondary haulage is generally by either electric or compressed air hoists.

Of the 876,731 long tons of coal produced by the Company in 1907, there was used in the manufacture of coke 322,870 tons, yielding 206,541 tons. The coke is used largely in south-eastern British Columbia and partly in the

United States. The balance of the coal is divided between domestic and United States consumers.

The Crow's Nest Pass coal is a bituminous coking coal. A typical analysis shews:—

Volatile combustibles	22.19
Fixed carbon	70.99
Ash	5.60
Moisture	0.90
	99.68
Sulphur	0.32

The Western Fuel Company's collieries, at Nansimo, Vancouver Island, are the oldest now working in the Province. First opened in 1852, when coal sold for $28 per ton in San Francisco, they fell into the hands of their present owners in 1902. The Western Fuel Company was incorporated under the laws of the State of Cslifornis, with sn authorized capital of $1,500,000. Upon acquiring the Nsnaimo collieries, the Company adopted s policy of vigorous expansion. Its holdings include those portions of the Nanaimo coal-field surrounding aud underlying Nanaimo Harbour and underlying the neighbouring islands. Nansimo Hsrbour is the main shipping plsce. The Company owns whsrves and 2,000 feet of froutage. It now operstes three collieries: No. 1 shaft at Nansimo; Protection Island mine; No. 4, Northfield mine.

The Western Fuel Company's output for 1907 was 504,292 long tons. This was slmost equally divided between tho domestic aud the United States markets.

The Nanaimo veins vsry from 3 feet to 30 fect in thickness. The coal is bituminous, aud somewhst high in volstile matter. The following analysis indicates the uature of the fuel:—

Volstile combustibles	35.84
Fixed carbon	54.79
Ash	5.50
Moisture	2.86
	98.99
Sulphur	1.01

The Wellington Colliery Company owns snd operstes the following mines on Vancouver Island: The Extension colliery, in Cranberry district; the Union colliery, in Comox district. The Compsny slso owns old collieries now idle.

At the Extension collieries arc three mines whose product is shipped from Ladysmith, a town on Oyster Harbour. The veins range from 6 to 15 feet in thickness.

The Union collieries, at Comox, include five mines. The coal is somewhat higher in ash and sulphur than other provincial coals. The following is an analysis of coal from No. 5 pit:—

Volatile combustibles	29.24
Fixed carbon	57.03
Ash	9.60
Moisture	1.08
	96.95
Sulphur	3.05

During 1907 the Wellington Colliery Company produced 824,138 tons of coal. In their bee-hive ovens at Union Bay, 16,372 tons of coke were made, from 33,344 tons of washed coal. The bulk of the coal produced was sold and used in British Columbia. The balance went to the United States.

Copper, Lead, Silver, Iron.—The metalliferous mines of Southern British Columbia are too well known to require specific mention. The smelters of the boundary and adjacent districts produce all the lead, and much of copper and silver credited to the Dominion. On the coast the Tyee copper smelter is but the beginning of what will become in time a large industry. Cheap fuel, water transportation and large bodies of copper and iron ores, make it imperative that smelters be erected at suitable points on Vancouver Island, or at other well-situated localities on the mainland.

Recent developments indicate that British Columbia is to have an iron industry. When this is brought about the Province will have all the essentials of a well-rounded mining industry.

Total Annual Mineral Production in British Columbia (As published by the Bureau of Mines, British Columbia).

Year	Value of Production	Year	Value of Production
1852 to 1889 (inclusive)	$71,981,634	1899	$12,393,131
1890	2,608,803	1900	16,344,751
1891	3,521,102	1901	20,086,780
1892	2,978,530	1902	17,486,550
1893	3,588,413	1903	17,495,954
1894	4,225,717	1904	18,977,359
1895	5,643,042	1905	22,461,325
1896	7,507,956	1906	24,980,546
1897	10,455,268	1907	25,882,560
1898	10,906,861		

Total Mineral Production In British Columbia for all years up to and including 1907.

Gold Placer	$69,549,103
Gold lode	45,070,717
Silver	27,289,833
Lead	19,917,197
Copper	43,713,122
Coal and Coke	86,972,511
Building stone, brieks, etc.	6,693,100
Other Metals	320,699
Total	$299,526,282

Yukon District.

The Yukon District lies to the north of British Columhia, in the extreme north-west of the Dominion, hetween the Mackenzio River and Alaska.

As early as 1878 the country was known to he gold-hearing. The bars of Lewes and Salmon Rivers were exploited in 1881 and 1882, and the Stewart in 1883. Coarse gold was first found in Forty Mile River, a trihutary of the Yukon River, in 1886. From Forty Mile River the productive field was extended across the local watershed to the trihutaries of Sixty Mile River. Thus when the wonderful gold-hearing gravels on the Klondike River were diseovered in 1896, there was already a considerable population in the country. The stampede that followed this diseovery was one of the wildest in the history of mining.

The yield of gold now advanced hy leaps. From an estimated output of $300,000 in 1896, it rose to a maximum of $22,275,000 in 1900. Thereafter it declined. The output reported for 1907 was only $3,150,000. For 1908, however, there is likely to be a larger return owing to the open season and the aetivity of dredging eompanies.

For two years after the Klondike discovery mining was exclusively confined to the gravel deposits in the valley hottoms, and was performed hy hand with primitive implements. The frozen gravel was generally covered by a layer, light or heavy, of solidly frozen vegetable muck. Thawing was a eostly process. It is still a controlling factor. Ground-sluicing and drifting were the earliest mining methods. By the former method the gravel was thawed hy means of sluicing and exposure to the summer sun. In drifting, wood fires were employed to do the thawing. Both of these operations were enormously costly, averaging fro $5 t: $25 per cubic yard, but the richness of the gravels rendered the cost of extraction insignifieant.

Steam thawing was introduced in 1899. Otber improvements followed rapidly. But outputs fell conaistently from 1900 on, and the fabulous Klondike gravels had no successors.

The cost of alluvial mining in tbe Yukon district bas decreased with the advent of railwaya, ateamship lines, telegraph linea and other modern requirements. Mining methoda bave been vastly improved. The modern dredge can work at a profit gravels that were worthless a few years ago. The country undoubtedely has a prosperous future before it.

Good lignite coal bas been discovered about 40 miles below Dawaon and mined. Last year the output was 5,000 tons. It is now proposed to generate power at the mines to operate the Klondike dredges. Copper ores, galena, gold-hearing quartz are found in payable quantities. Large stibnite veins occur near Whitehorse.

The Yukon summer ia sufficiently long for the growth of crops almost to thc Arctic Circle. The winter is very little more severe tban that of Manitoha.

Annual Production of Gold in Yukon District (as published hy Department of Mines, Ottawa).

Year.	Value.	Year.	Value.
1885 and 1886.....	$ 100,000	1898.....	$10,000,000
1887.....	70,000	1899.....	16,000,000
1888.....	40,000	1900.....	22,275,000
1889.....	175,000	1901.....	18,000,000
1890.....	175,000	1902.....	14,500,000
1891.....	40,000	1903.....	12,250,000
1892.....	87,500	1904.....	10,500,000
1893.....	175,000	1905.....	7,876,000
1894.....	125,000	1906.....	5,600,000
1895.....	250,000	1907.....	3,150,000
1896.....	300,000		
1897.....	2,500,000	Total.....	$124,189,500