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Introduction.

This age has been appropiately termed "The Iron Age". While iron is without doubt the most useful mineral in the field of science and invention, there are many other minerals which are also very important. Nickel will probably become almost equal to iron in the scope of its usefulness in the arts. Other minerals, that were once thought useless, are proving themselves valuable, some almost invaluable. The mineral Cobalt is a good example. It was first thought worthless but later its oxide was discovered to have the power of coloring glass. It now forms the basis of all blue color in the manufacture of glass and porcelain. Minerals perhaps more than anything else build up the greatest Nations. Great Britain, Germany, the United States, probably owe their greatness in a large measure to their splendid deposits of economic minerals. The increasing demands being made upon their mineral resources must bring about a decline in their output, must inevitably exhaust mines that for richness and magnitude have been unprecedented in the history of the world.

The country of the future is the country with mineral deposits, dormant and unexplored, yet rich and great as the mightiest gone before. Such a country we believe our own Canada to be.

Canada, so long looked upon as a great frozen waste, barren alike in agriculture and mineral resources, is to-day rapidly taking a place in the very front rank of agriculture Countries; and she is also surpassing the world with the richness of her mineral deposits. In speaking of the Granby Copper mines at Phoenix B. C., Mr. John Stanton, who has been designated "Father of the Copper Industry", said:- "The Granby ore body is the largest sulphide deposit I have ever examined and my experience has extended to every variety of Copper ore. It is analogous to the famous Rio Tinto of Spain. It is larger than the famous Tennessee deposit. Hitherto sulphide ore bodies from 40 to 80 feet wide have been considered large but this one at Phoenix eclipes anything I have ever seen. The millions of tons of ore in sight and the vast stopes proved a veritable revelation to me". [1.]

Although the United States is one of the two great Copper countries of the world, yet she eagerly buys Copper pyrites from the Capleton mines in Quebec; admitting it better than her own for the manufacture of Sulphuric Acid.

Mr. H. E. Parrish, C. E. and M. E. of the Geological Survey of Pennsylvania, in speaking of the coal deposits of Vancouver and Queen Charlotte Islands said: "With the knowledge I have of the coal regions of Pennsylvania, acquired there as a mining engineer and on the geological staff of that state, it must gratify you to [2.]

1. Review of Mining in B. C. Bulletin No.19

2. Article on coal in Report of Section of Mines, 1902.

know that, in my judgment, you have the best coal field I have seen. Until I visited it I had no conception such a valuable field existed on the Pacific Coast. You possess a number of beds of superior quality and unusual thickness".

1. Canada's nickel deposits at Sudbury are now well known. She and New Caledonia are the two great nickel producing countries of the world and Canada's production now exceeds that of the French colony. Nickel has become a very important metal since it was discovered that a mixture of 30 per cent nickel in steel doubles its strength. It is now perhaps second to iron.

The recent discoveries of Cobalt- nickel- arsenic- silver mines near Lake Temiskaming are unique on this continent and place Canada on a par with the famous Joachimsthal region of Saxony.

2. Dr. P. L. Heroult, technical director of the French Electro Metallurgical society, says, "In ten years Canada will have an iron industry larger than any other in the world". He has installed a plant at the "Soo"to experiment in smelting iron ores. This system is a success in La Praz, France, in Syracuse, N. Y., and other places and there is no reason why it should not be a success in Canada. If so Canada's immense iron deposits and her mighty water powers will enable her to produce iron cheaper than any other country in the world.

In gold mining Canada's lode mines would seem to take a very low place when compared with such famous mines as The Homestake of South Dakota, the Boulder, Perserverance, Golden Horse-shoe and others of West Australia; The Champion Reefe and Mysore of India; the large Transvaal mines etc. These mines owe their fame to the great amount produced rather than to the high grade of their ores. The Australian mines go down to great depths the shaft cutting one saddle reef below the other to a depth of 2,000 feet or more. In Nova Scotia
3. mining has always been confined to one saddle reef. This was largely due to the extensive nature of the leads in Nova Scotia and to lack of knowledge as to the nature of the deposits. Now, however, deeper mines are being sunk and it is at least possible that Nova Scotian mines may rival the worlds great producers.

In placer mines those of the Klondike are said to be the richest ever discovered. Over $100,000,000 worth of gold has already been produced. Colonel Conrad still claims his mine at Conrad to be the richest in the world.

1. Report of Bureau of Mines Ontario 1905.
2. Article Winnipeg Free Press.
3. Gold measures and Deep Mining in Nova Scotia by E. R. Fairbault.

In silver Canada's mines bid fair to place her in the front rank, the wonderful richness of the Cobalt district bidding fair to parallel the famous Silver Islet of Lake Superior where $3,500,000 worth of silver was taken from an island too small to support adequate surface workings for the mine.

1. The Canadian production of platinum is not large, about 650 ozs. per year from Sudbury, 30 ozs. from Similkameen district of British Columbia, and a small amount recovered from the placers of the Yukon. Yet she has the chief, if not the only, supply in North America. There is a probability that the amount from British Columbia will increase, as a number of the sluice and hydraulic mines have been making no attempt to save it.

Diamonds have not yet been definitely located in Canada but they are found in the glacial drift of Wisconsin, Michigan, Indiana and Ohio and these undoubtedly had their source in Canada.

2. Canada's peat bogs are immense in extent and when fully explored it is believed will equal those of Russia whose mighty steppes are known to possess 67,000 sq. miles of peat.

In short our youthful country is already assuming giant proportions in many industries such as agriculture, lumbering, etc. promises to parallel these proportions in the equally important industries of mining and manufacturing.

The mineral regions of Canada may be arranged in four divisions viz:-
(1) The Eastern division, comprising the St. Lawrence valley in Quebec, South-eastern Quebec and the Maritime Provinces.
(2) The Laurentian area with its flanking deposits of Devonian Siliurian etc. in Western Ontario, Huronian in Algoma, Animikee, etc. in Thunder Bay.
(3) The great prarie tract.
(4) The Western Division or Rocky Mountain plateau.

The mineral resources of each Division will be describes in the following pages.

I Division.

The chief minerals of this region are gold, coal, iron, copper etc. of Nova Scotia, the gold, copper, and asbestos of Quebec, the Gypsum, etc. of New Brunswick.

The gold measures of Nova Scotia exist in rocks of lower Cambrian series. They are of sedimentary origin and are divided into two layers, a lower layer of quartzite, and an upper layer of slates. The quartzite contains the gold. This region has been subjected to some enormous force which has squeezed the strata into ridges running parallel with the coast, and reduced its former

1. Bureau of Mines, Ontario 1905.

2. Bulletin on Peat by R. Chalmers L. L. D.

width about one-half Glacial action wore off the tops of the ~~anti~~ anticlines and thus exposed the lower quartzite or gold bearing strata, in places. The pay streaks all exist near the apex of the anticlines, and here the mines are situated. The district occupies about 5000 sq. miles along the eastern side of Nova Scotia and contains about 30 mines. The ores are all free milling

1. The amount of gold mined in Nova Scotia has been rather declining during recent years. But this, it is claimed, is on account of the small leads and chimneys being exhausted to a depth considered profitable for mining on a small scale, thus putting out of business the small miner and tributer. Henceforth, if the work is to be profitably carried on, the mines must be sunk to a greater depth, and this necessitates the investment of greater capital. The governmen government of Nova Scotia passed an act in 1903 to assist in sinking mines to a depth of 2000 feet, and , as a result, at least two mines have been sunk to a depth of over 1,000 feet, and gold in presumably paying quantities found in each.

2. The ore of Nova Scotia is, however, of a low grade, and it is a difficult matter to make gold mining pay. The only salvation of the industry seems to be in the harnessing of the splendid dormant water powers so freely distributed over the provinces. This has been, in the case of the Dolliver Mountain Mine, with a substantial saving in cost.

Gold was probably discovered by the early French settlers in Nova Scotia. According to tradition it was first found in the county of Lunenburg. The first discovery of which we have positive information was by Daniel Dinock and David Whitford in 1861. The earliest discovery was followed by so many others that it was at first believed that the whole of the province was auriferous. Gradually, however, it became evident that the workable deposits of free gold were confined to the metamorphic rocks of the Atlantic coast.

3. Rocks that are supposed to be of the same age as the gold measures of Nova Scotia exist in New Brunswick. They extend from the western boundary of the province to Bathurst on the Bay of Chaleurs. These are mainly slates and quartzites with their metamorphic equivalents. They are mostly non-fossiliferous, and so doubts exist as to their geological age, which is also true of the gold measures of Nova Scotia. Numerous stories of gold finds have come from this region in New Brunswick and some parties even went so far as to erect a small stamp mill but as yet no gold has been found in paying quantities.

In Quebec rocks analogous to the gold measures of Nova Scotia are found south-east of the St. Lawrence valley. The rocks of the St. Lawerence valley, the so called Sillery formation, are now also

1. ~~E. R. Fairbault-on-Gold~~ Department of Mines Nova Scotia 1904.
2. Report of Department of Mines N. S. 1904.
3. Mineral Resources of New Brunswick by L. W. Bailey , Ph. D.

supposed to be the metamorphic equivalent of the lower Cambrian rocks found in the so-called "Eastern Townships."

1) The existence of gold in Quebec was noticed in 1835 in the valley of the Chaudiere. The descovery was accidental. Following this Charles D. Lery, secured he exclusive right to mine for gold in Beauce County. He began washing in company with James Douglas and established the presence of gold in notable quantities even finding some large nuggets in 1846.

Work was carried on, in a desultory and unsystematic way, for about 20 years. Legal difficulties also interrupted the progress of mining. In 1867 Mr. Lockwood hot control of a considerable tract of land and began developments in a systematic way. He is now considered the chief developer of the region. At first gold was sought only in the river beds and flats. Mr. Lockwood showed th that, to prosecute the work with success, excavations should go down to the old river channels buried deeply beneath the present level. Shafts were sunk from 30 to 160 feet in depth to the auriferous gravel, which was a layer of 5 or 6 feet upon the bed rock. The cracks in the rock also contained gold, necessitating the working of several feet of rock.

At the junction of the duLoup and Chaudiere rivers extensive surface alluvial deposits exist. Mining by the hydraulic process was tried, a flume 20 miles long being built, which gave a head of 150 feet of water. Still the method was not a success and was soon abandoned.

It has been pretty well established that the source of the alluvial gold is local, being derived from quartz veins traversing the Cambrian slates of the region. These are found to be gold bearing nearly everhwhere. Pieces of gold are often found sticking to the quartz. The alluvions near the quartz are very rich, the gold is coarse showing that its source is not far off. Working of the quartz has been little attempted however.

The Beauce region occupies 1500 sq. miles in the valleys of the Chaudiere and duLoup. The richest region is along the Gilbert river, and here nuggets have been found weighing 50 ozs. or more.

Some gold is got from the Pyrite mines near Capleton.

COAL.

(2) In Nova Scotia there are several extensive areas of bituminous coal which have been mined for many years. New Brunswick has a smaller area. The rocks are the carboniferous, which occupy a large triangular portion of central and eastern New Brunswick, and the North Eastern part of Nova Scotia, including a considerable portion of Cape Breton.

In Nova Scotia we have the following coal fields: Sydney, Inverness, Richmond, Picton and Cumberland. The Sydney field is situated in the North Eastern part of Cape Breton County, and takes in a part of Victoria County. It is 200 sg. miles in area and is bounded on three sides by the ocean. The region is easily worked, being without faults, and has splendid shipping facilities, making the point probably the most important in the Dominion for the supply of fuel to Atlantic steamships. Sydney harbour is one of the finest and most commodious on the Atlantic coast of North America. When this harbour freezes during winter the collieries find an outlet for their products at Louisburg a fine open harbour safe at all times for shipping.

The greater part of this coal field is hidden under the sea, but the measures containing the coal are composed of argillaceous shales and sandstone, the solidity and coherence of which favor sub-marine exploitation.

The aggregate thickness of the seams is from 40 to 50 feet. The individual seams vary from 3 to 9 feet in thickness, and dip seaward at low angles. From experience at Sydney, it has been fully established that, with due caution, the sub-marine areas may be worked to a large extent.

The Sidney coal field was the first one opened in Canada. In 1785 work was done on it by the government. This was of a desultory nature, however, and it was opened to systematic and regular mining only in 1827.

The Inverness Coal fields occupy a narrow strip from Judique to Margaree on the West Coast of Cape Breton. Seams of workable size have been found at Port Hood, Mabou, Inverness, and Chimney Corner. They all dip seaward at low angles. A great drawback to the development of this area is the lack of shipping facilities, the region being without good harbours. In 1900 a railway was built from Inverness to Port Hastings and thence to join the Intercolonial. Since then mining operations on a large scale have been commenced.

Coal occurs in the south western portion of Richmond county but little systematic mining has been done.

The Picton Coal field occupies the centre of Picton County. It comprises about 25 sq. miles and although of small area its seams are very large, two of them being 40 feet thick. It has splendid railway facilities, but the physical difficulties in mining are great as the region is surrounded by faults. The character of the coal in the same seam changes inshort distances. The field was opened in 1798 but systematic mining began 1827.

The Cumberland field is the most westerly in Nova Scotia, part of it being adjacent to Chignecto Bay. There are two areas viz:-The Joggins near the seacoast, and the Springhill fifteen miles inland. These are seperated by a development of Permian strata, which is affected by several faults.

The Joggins area is a narrow strip 18 miles long, containing five five mines in most of which two seams are worked. These seams are from four to six feet in thickness. At Springhill 3 seams are worked. This mine produces a coal specially adapted for steam purposes, and the produce of the mine is largely used by Intercolonial, Canadian Pacific and Grand Trunk Railways.

In New Brunswick the carboniferous rocks, which cover a large area, do not contain the coal measures of Novia Scotia. It was expected that south of the coastal range, rocksand seams similar to those of Nova Scotia would be found; but exploitation here has not met with much sucess. So the productive coal fields of New Brunswick are confined to an area of about 100 sq. miles at the head of Grand Lake. The seams here are thin and lie almost horizontally. They are covered with surface drift varying from a depth of 2 to 30 feet, and may be worked by opencast method. The coal is excellent but the seams are too thin-being from 15 to 20 inches in thickness-to be profitably worked. Operations were commenced in a small way, 50 years ago but the beds are now worked only for the local market.

I R O N.

(1) Iron is mined at Londonderry and Torbrook in Nova Scotia. The ores are ankerite, limonite, and hematite. Other iron ores are found in different parts, magnetite in Annapolis County and Bog Iron ore in Mira County, Cape Breton and also at Bridgeville, Pictou County. Blast furnaces are in operation at Sydney, New Glasgow and Londonderry.

The rocks containing iron are mainly carboniferous and the mines are all less than 200 feet in depth. The discovery of iron mines on Bell Island Newfoundland, which can be easily and cheaply worked, caused the furnaces of Nova Scotia to bring iron ore from these. The amount mined in Nova Scotia is less now than ten years ago.

Shipments of pig-iron are sent from Cape Breton to Glascow Scotland at prices to sucessfully compete with the Scotch pig. The unexcelled shipping and loading facilities at the Newfoundland iron mines, and also at the iron works and mines in Cape Breton, coupled with modern arrangements in machinery, reduces the cost of production to less than what is possible under present conditions in any British mine. These advantages also enable the Nova Scotian iron mines to successfully compete with the large iron mines of the United States.

(1) Section of Mines Annual Reports 1901, 02, 03.

(1) The iron ores of New Brunswick are: the Hematites and Limonites of Carleton County, the Hematites and Specular ores of Black River and West Beach, St. Johns County, the magnetites of West St. John and Charlotte Counties, and deposits of Bog Iron from various localities.

The Carleton beds extend across the county, but have their greatest thickness at Jacksontown. The rocks are Silurian and consist of bluish or grayish slates, or, when associated with iron, reddish or greenish. The beds are numerous at Jacksontown and average from one to sixteen feet in thickness. Individual beds vary in width greatly. They contain manganese giving a black color.

The first furnace was erected in 1848. A smaller and improved one was erected in 1863 using limestone as a flux. This limestone was obtainable near by at Beccaguimac River. The cost of production, however, combined with difficulty of transportation led to cessation of operations. The presence of phosphorous was also a difficulty, as it made the product brittle or cold-short and detracted materially from its value. The new basic process of Thomas and Gilchrist makes possible the smelting of such ores. It is also possible that processes may be invented to use the nickeliferous pyrite of St. Stephen with these ores, the product making an iron suitable for armour plates.

The ores of Black River and West Beach both occur in rocks that are pre-Cambrian probably Huronian. No serious attempt at mining has occurred.

(2) In Quebec iron occurs in the magnetic state in rocks and in sands. It also occurs in the form of hematite and bog iron ore.

The ores of magnetite and hematite are found in the Laurentian formation in Pontiac, Ottawa, and St. Maurice counties, and on the North Shore of the Gulf of St. Lawerence in the form of magnetic sands. They also occur in the Cambrian and pre-Cambrian formations of the Eastern townships, Sherbrooke, Beauce, Megantic, etc. These deposits are among the richest and most extensive in Canada; but, as fuel for smelting is not available all works have been suspended. A new process of forming briquettes of the sands of the North Shore is being discussed, also a process of agglomerating and smelting these sands by use of electricity. The sand is met with, almost on the surface, in layers of from one half inch to two and a half feet in thickness. The beds often extend over several leagues.

(1) Mineral Resources of New Brunswick, by L.W.Bailey.

(2) Minerals of Quebec, by J.Obalski.

The bog ores are hydrous peroxides of iron containing a large proportion of organic matter. They occur in patches or beds on or near the surface in the alluvions, frequently associated with deposits of peat. They have a honey-comb appearance and are easy to smelt, the organic matter facilitating reduction. They are particularly adapted for castings, and stove works etc. have been supplied for years from St. Maurice forges.

The two chief places where Bog ores are mined and smelted are at Radnor, thirty miles north of Three Rivers, and at Drummondville in the county of Drummond. These are the only works that have been in operation during the past ten years. The mines at Radnor are among the oldest on the Amreican Continent, as a French company began operations here in 1737. They were abandoned at different times owing to scarcity of fuel. The mines at Drummondville are also old. Other places worked at present are in Jolliette, Nicolette and Vaudreuil counties.

Mining operations are crude. The ore is delved out of open quarries by means of pick and shovel. It is washed before being sent to blast furnaces.

The deposits of Bog ore vary in thickness from a few inches to seven or eight feet; and cover surfaces varying from a few acres to several square miles. They are sometimes found in lake bottoms as at de la Torture. The prevalence of these deposits in the St. Lawrence valley led to the building of blast furnaces which used charcoal prepared in the neighboring forests as fuel; and turbines operated by the swift streams supplied blast. The product of the Radnor forge is especially suitable for the making of car wheels.

Titanic iron ores also occur in various parts of the province, especially in the anorthosite rocks of the upper Laurentian. Titanium is of such limited use in the manufacture of paints and dyes, and the ores are so lean in iron, that they have attained no economic importance.

Chromic iron ore is found in the counties of Brome, Gaspe, Megantic, Beauce andWolfe. It occurs in the Serpentines of the Cambrian formation; but in such small pockets that extensive operations can not be carried on. The use of chromium salts, until recently, was confined to the making of pigments or dyes. Now it is used to make chrome steel which is remarkable for its hardness. This has increased the demand for chromic iron ores.

Ochres are found on the St. Maurice associated with bog iron ore.

Copper

(1) Copper occurs in the maritime provinces in widely different geological formations viz:- First: In crystalline rocks, felsitic in character, mainly found in Cape Breton. The ore is a copper pyrite associated with iron pyrite and sometimes with galeva, zinc blende, and small quantities of gold. The deposits are of small extent and give

(1) Bulletin on Copper in N. S., N.B. , and Que.by E. W. Ells. L.L.D.

little promise of successful returns for development. The largest ore bodies are at Coxheath and Cheticamp. Similar ores are found in New Brunswick on the north shore of the Bay of Fundy. The rocks are pre Cambrian, probably Huronian. Mines were opened in St. John and Albert counties.

Second: In intrusive diorites which cut the Devonian and Silurian strata in Eastern Nova Scotia. The ore occurs at the point of contact of the limestones with the underlying Conlomerate. They are found at Irish Cove and at Middle and North River Cape Breton, and often contain a small percentage of gold. Similar eruptive rocks are found in New Brunswick. They cut the Silurian and Devonian formation of Adam and Lettie Islands south of Charlotte county.

Third: Copper ores are found in the upper Carboniferous and Permean rocks south of Northumberland Strait. These ores are gray sulphurets and carbonates of copper, and owe their origin to organic matter acting on Copper in Solution. They are found mainly in Picton, Colchester, and Cumberland counties. The ores are high grade containing 60 to 70 per cent of copper; but the deposits are scattered and poor success has attended attempts at mining, although large sums have been expended on mining operations on French, Wallace, and Waugh Rivers

Similar ores are found in New Brunswick. They occur as gray copper ore, thrown down by organic remains, in the sandstones and conglomerats of the Carboniferous formations at Bathurst, Cloucester county; and Dorchester, Westmoreland County. Large sums have beenexpended on mining operations, among others an electrolytic attempt being made 1890, but all proved unsuccessful.

Fourth: In the great trappean outflow of the North Mountain range and in similar outliers on the north shore of the Basin of Minas, pure or native copper is found. It is sometimes green on the surface throu through oxidation. It was discovered as early as 1608, by Lescarbot an early French settler. The most noticeable deposits are at Cap d'Or where the scales of yellowish color are seen in the trap. This led to the idea that gold was contained and gave the locality its name. The cliff here is 350 feet high. An attempt to mine the ore about 30 years ago resulted in failure. In 1900 the colonial Copper Co. got control o of 2300 acres and erected a mining and concentrating plant costing several thousands of dollars. What success they shall have is not appar ent.

Native copper occurs in the trap of supposed Triassic age on the western side of Grand Manan Island, New Brunswick. The area is regarding as contemporaneous with the igneous rocks of the North Mountain range in Nova Scotia. Similar failures to mine the ores have been met with.

Copper in Quebec.

In Quebec copper occurs in three parallel belts in the eastern townships. The first belt extends from Franham, near Missisquoi Bay, on Lake Champlain, to the seignory of Lauzon on the St. Lawrence.

This belt is in the Sillery formation and is separated into parts at St. Francis by underlying slates. Here, in this supposed synclinal, occur the mines of Uptom, Action, Weckham, Wendouin, Somerset, and Nelson. In this belt we have one of the principal mines of Quebec.

The second belt runs from St. Armaud to the Seignorie of St. Mary's on the Chaudiere. It is divided into two parts by the Sutton range of mountains. In the south-west parts are found the deposits of Stukely and Melbourne; and in the northeast those of Halifax, Leeds, Inverness and St. Mary. This, and also the third belt, are in rock formation different from the first. Here the rocks are regarded as belonging to pre-Cambrian formation.

The third belt extends from Owl's Head on Lake Memphramagog to the township of Ham. This includes the deposits of Ascot, Ham and Gwathby.

Although iron was known to exist in Quebec two hundred years ago, copper was first discovered in 1847. Early mining was a failure.

Action mine was discovered in 1858. This led to aboom in copper mining which brought to light the second belt containing nunerous deposits. The Haverhill mine was the second discovered. The ores of the second group are wasoviterous and contain some native gold. The deposits of the third area have proved the most valuable during recent years on account of their suitability to the manufacture of Sulphuric Acid. The ores differs from that of the other two belts, being a chalcopyrite with a small percentage of copper, an appreciable amount of silver, and about $5 to the ton in gold. Here are situated the Capleton mines which of late years have been the only copper mines worked in Quebec. The amount mined is decreasing though not because of diminution of ore supply. The growing importance of the ore is being recognized by men interested in the manufacture of Sulphuric Acid in the United States.

Minerals of Minor Importance.

This division contains a vast number of minerals of lesser importance. Lack of space forbids a full description of these but as rocks of contemporaneous formation in New Brunswick and Nova Scotia have very similar minerals constituents these minerals may be classified according to the rocks in which they are found.

The Laurentian occupies a small area in St. John Co., New Brunswick, and also a small area in northern Cape Breton and small Islands nearby. Its economic minerals are granite, limestone

(1) Summary reports of geological survey 1901.

(extensively quarried and calcined) graphite and magnetite, serpentine with small veins of asbestos, and small veins of argentiferous galena//

(1) The Huronian formation occupies a small tract in the southern part of New Brunswick and a Much larger tract in the northern part, about the head waters of the Tobique and Miramichi rivers, is also supposed to be of Huronian. Besides iron and copper ores, already mentioned, this region contains the Nickel pyrhottites of St. Stephen.

These ores occur in exactly similar conditions to those of Sudbury and New Caledonia, but they contain too small a percentage of nickel for economic working.

The Cambrian and Cambro-Silurian occupy small areas in Southern New Brunswick and a large tractin the north extending from the Maine boundary to the Bay of Chaleurs. This formation also occupies almost the entire Atlantic coast of Nova Scotia. The minerals are iron, copper, manganese and lead. This also the gold measures of Nova Scotia and the region of reported gold in New Brunswick. Antimony is also found in York couty New Brunswick.

(2) Lower Carboniferous seems to underlie the whole area of coal measures in New Brunswick. It crops through in places and is mainly developed in Nova Scotia mainly in Hants county and in western part of Cape Breton county. The minerals are bituminous shale, cannelite and albertite. Pretoleum is found in albert county New Brunswick . Deposits of gypsum are found at Hillsborough in Albert county New Brunswick and in Hants county Nova Scotia. It is mostly exported in the crude state to the New England states where it is used in the manufacture of Plaster of Paris, hard wall plaster, Alabastine, Terra Alba atc.

The gypsum from Hillsborough is the best found in Canada and it is superior to anything found in the United States.

The millstone grit of the Lower Carboniferous is found in eastern New Brunswick and western and northern Nova Scotia. It furnishes grindstones, pulpstones, building stones(freestone gray, purple and Olive) and fire clays.

Manganese deposits occur in Lower Carboniferous . The most noted are in New Brunswick at Markhamville and Judiac mountain (Kings co/,) and at Quaco(St. JohnCo.,)

(3) In Nova Scotia manganese is found in western Cape Breton co.? at the head waters of the Salmon river and at Loch Lomond are some of the most important deposits of manganese found in Canada. It is both crystalline and massive in form and is remarkably pure and free from iron. It is well adapted to chemical manufacture. A large proportion is pyrolusite. As these ores are largely used in steel manufacture and as the iron and steel industries of Nova Scotia are growing rapidly these deposits may become valuable sourses of ore.

(1)Summary Report of Geological Survey 1901

(2) Mineral resources of New Brunswick by L. WL Bailey

(3) Section of Mines 1903. Article on Manganese.

The Triassic rocks occur on the shores of the Bay of Fundyin New Brunswick, in the volcanic beds of the Grand Manan Island and on the west coast of Nova Scotia. The only economic minerals are the road making materials of the Grand Manan rocks.

The Pleistocene includes several beds of sand, gravels, and clay distributed over preceding formations as a result of glacial or marine action in Post Tertiary times. In these deposits occur infusorial earth or tripolite and beds of peat.

(1) The most important deposits of infusorial earth are found in Nova Scotia. These are;- In Cumberland county at Folly Lake and Fountain Lake. At Folly Lake the deposits comprise the bed and shores and of the lake. They are worked for the manufacture of polishing material and non conductors. Cobequid mountain district is fulllof small lakes containing infusorial earth. In Picton county and in Cape Breton county small lakes have infusorial earth deposits.

The deposits best known in New Brunswick are;- in Kings county at Pollet river lake and Lake Pleasant;and in St. Johns county at Fitzgerald Lake. This latter is a large bed of 50 acres in area and 50 feet in depth. The lake has been drained so the depodit can be worked.

(2) Some slight deposits of marl are found in New Brunswick near St. John, but the marl deposits of Ontario and Quebec are unknown in the maritime provinces, although infusorial earth seems to take their place.

(3) The graphite deposits of Nova Scotia, New brunswick and Quebec are deserving of a fuller description. Graphite is usually found in the pre-Cambrian rocks. There has been little development of the Nova Scotian deposits. It is found in Cape Breton in pre-Cambrian rocks (crystalline limestones with shales and slates, associated with granite intrusions). The localities are, Glenvale, River Inhabi-ants, Inverness CO., where it is found in red syenite full of graphite specks. At Dallas brook it occurs in felsites, limestones and slates. The limestones are graphitic and are sometimes burned for lime. These black shaly beds were at one time mistaken for coal. Guthro Lake has a variety of graphitic shale. The band here is two or three feet wide. The graphite from here when purified is of fair quality, well adapted for lead pencils, electro-typing atc. Its value depends on the cost of extraction and preparation.

Graphite is found in Guysborough county in black shales of Devonian age. It is reported from numerous places such as West Bay, Grand Narrows, East Bay and Hunters Island. Little is known of these deposits as little mining has been done for years.

(1) Section of mines 1903, article on Infusorial Earth.

(2) Marl deposits of N. S., N. B., Ont., and Que. by R. W. Ells.

(3) Bulleton on Graphite by R. W. Ells.

In Quebec bands of graphite occur in the Grenville limestones north of the Ottawa river Plumbago also appears in altered rocks at the base of the Palaezoic series in the Eastern Townships. It is generally finely disseminated in calcareous or argillaceous shales, making them soft unctuous and shiny. Is is nowhere in the Eastern Townships found in sufficient quantities to be of economic importance Deposits are found at Granby, Melbourne, and St. Henripin the latter case inclosing graptolites. The deposits in Massachusetts, in the continuation of this metamorphic region, belong to the carboniferous ~~metamorphic~~ System. They are altered coal. By analogy the Lawrentian deposits of Canada suggest the accumulation of organic matter in the sediments of that remote period. The Lawrentian deposits will be treated in the Lawrentian division.

Asbestos.

(1) The asbestos beds occur in Serpentine rocks of the lower Cambrian in South eastern Quebec. In the Eastern Townships where large workable deposits are found the Serpentine occurs as an alteration product from great masses of olivine diabase which run in an irregular band from the border of Vermont to the Gaspe peninsula. The associated rocks are usually hard schistose slates and quartzites of the Cambrian age occasionally intersected by quartz veins. The development of Serpentine in the Eastern Townships is extensive, but the rock characteristics vary greatly. This is due to the amount of alteration the olivine diabase has undergone.

Serpentine is a hydrous silicate of magnesia but the percentage of water varies greatly in different portions of the rock mass. When it falls below a certain percentage the rock becomes too dry and hard to produce asbestos veins of size and texture suitable for economic working. This hard condition u is found in much of the rock of the Serpentine area. Even round Thetford and Black Lake, where the most productive areas are found, barren regions are found apparently from this cause. All the asbestos of this field belongs to the variety chrysotile.

The serpentine occurs in masses inthe Sillery formation. This region has undergone some great pressure from the south east. This crushed and folded the schists producing a slaty structure. The rocks about Thetford and Black Lake withstood this pressure are more massive.

The asbestos veins, which traverse the Serpentine in all directions probably owe their origin to fissures formed during these movements. Some were evidently formed prior to the final crushing, as some veins are little disturbedhowever, and are still at right angles to the walls of rock. Sometimes granite dykes intrude and have influenced vein formation, for, of ten, as the workings approach the dykes the number of veins increase and sometimes the intrusions of granite cut off the rock entirely, so that the workings have to be abandoned.

(1) Bulletin on Asbestos by R. W. Ells.

In whatever manner the fissures were formed the filling in was doubtless due to segragation from adjacent sides, as quartz and other minerals are formed. Some of the larger veins show a comb of iron particles, while the rock walls are leached out and their color changed for some distance around the veins.

Certain conditions appear to have existed around Thetford and Black Lake by which the original gabbro was serpentized to a high state of perfection. Much good fibre is found and masses of rock without true veins contain disseminated asdestos suffisient in quantity to make the rock profitable for milling. This feature is absent from the dryer and harder rocks farther south.

Serpentine racks containing asbestos are found north-east of the Chaudier River and as far east as Gaspe peninsula. The great producing areas are around Thetford and Black Lake, however. Thess are said to be greatest if not the only mines in the world.

The minrs are worked by the open quarry system and some of them have reached a depth of 150 feet without any diminution of asbestos veins being noticed. Modern machinery such as cables, derricks, steam-trams and crushing mills are in use. The best varieties of fibre are hand cobbed. The poorer varieties are taken by trams to the mills where they are crushed and the rock is powdered by a series of "cyclones" after which the fibre is separated.

The annual product has increased from 380 tons in 1880 to over 40,000 tons in 1901.

In 1896 the manufacture of asbestos was commended. It is made from ground serpentine which contains disseminated asbestos. The product is adapted for fine wall plaster and interior decorations. It is by a by-product from the residue after milling.

Asbestos is called "rock cotton" by miners. Quebec supplies the largest amount to the trade although it is found in Italy, Corsica, Hungary, Sweden, Russia, South Africa, and South America. It is used for packing joints and covering steam and hot air pipes and for steam boilers, for packing breeches of cannon and to isolate electric wires. Felts to filter acids and to hold residues from the manufacture of oils are made from it. Packing-paper, wall-paper, felts,bricks, cements, paints, fire-proof safes (packing), clothing for fireman and iron workers, theatre curtains etc. are some of the innumerable articles made of asbestos.

Soapstone, a silicate of magnesia is also found in the magnesian rocks of the Eastern Townships. The only deposit worked is at Wolfestown. It is a soft unctuous mineral used for making slate and tailorss pencils. When powdered it is used as a lubricant and as a paint.

DIVISION 2.

The Lawrentian Area.

This region comprises the Lawrentian Mountain region with its flanking deposits of later formation in Ontario. The minerals gold, silve salt, petroleum and natural gas are chiefly found in the flanking deposit The Lawrentian proper is producing a group of unique or comparatively rare economic minerals. These are:-(1) The pickel deposits of Sudbury with by-products platinum and palladium. (2) The Corundum depositsof North Hastings and south Renfrew, and other areas of Eastern Ontario, which now supply by far the greater amount of corundum used in the world (3) The unsurpassed feldspar and mica mines of Frontenac and adjoing counties and the apatite, graphite and barite from the same district. (4) The iron ranges of notthern and north-western Ontarion not yet greatly developed. (5) The arsenic deposits of North Hastings which until a few years ago, were the only workings in North America. More recently the awriferous ores of Temagami were made known and lastly the cobalt-nickel-arsenides and silver mines near Lake Temiscaming. (6) The eastern part of this region is noted for minerals which while of little value are of great scientific interest. The largest crystals of Tircon in the museums of the world come from eastern Ontarion as do also sphenes pyroxenes, scapolites and other crystals.

Gold.

Gold has been reported from the Lawrentide Mountains of Quebec but work undertaken opposite Mattawa in Pontiac, near Buckingham, and in the counties of Jolliette, berthier and Montcalm did not turn out very profitably.

Gold mines in Ontario are found in Hastings and Peterborough chiefly near Marmora and Madoc. The chief mines in this region are Belmont Delora and Craig.

Small quantities of gold and silver are receovered from the matters of Sudburry nickel mines. The placer grounds of the Upper Vermillion river are receiving attention. The plan of putting a dredge at work is contemplated if the gold found in the immense gravel deposit of that region is ascertained to be present in payable quantities.

Gold was reported in 1903 at Webbwood station on the "Soo" branch of C. P. R. Gold has been mined at Michipecoton since 1897. The chief mines are Mariposa, Manxman, Grace and Sunrise. West of Lake Superior f gold was found at Jackfish Lake 70 miles north west of Port (1)Arthur in 1870. The Huronian Mine and the Heron Bay mine which was discovered 1872 were the early worked mines. Later in the nineties gold was discovered farther west at Lake of the Woods, Manitou Lake, and at Eagle and Nelson Lakes. This region has now a large number of mines but few are in operation. Some of the largest re. Sultana, Mikado, Big Master etc.

(1) Bureau of Mines of Ontario 1905.

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(1) Mines and mining on Lake Superior by Elfric Drew Ingall M. E.

The rocks containing the Lake of the Woods mines are the Huronian, which in this region has been called Keewatin. They comprise a layer of over four miles in thickness lying on the Laurentian rocks. The (1) region like the gold measures of Nova Scotia has been subjected to a great disturbance which forced the strata into ridges called anticlines. Quartz intrusive veins were probably forced while in a molten state into the cracks and fissures of the Huronian rocks during the time of this disturbance. These quartz veins are numerous and contain f gold and other minerals. The richest deposits are found where two quartz veins intersect. The anticlines run in a north-eastern and south-western directions.

The mines have shafts following the dip of the quartz veins. Some have reached depths of more than 500 feet. Most mines have stamp mills and surface workings. At Eagle Lake most of the mines are operated by one company They haul all ores by means of tram-ways to a central stamp mill.

The yield of gold from this, and indeed from all districts in Ontario, is continuously declining. The greatest output was in 1899 when the excitement in the Lake of the Woods and Rainy Lake district led to the erection of numerous stamp mills to test quartz veins. In some cases funds ran out before the mine was placed on a paying basis and the work was abandoned. The mining public anxious for dividends often rushed surface works before underground exploitation warranted such. This and the employment of unskilled managers in another evil which has helped to cast a depression over gold mining in Ontario. If pepple would concentrate their funds on the development of a few of the more promising and larger veins, instead of little promise, it is probable that more gold would be mined in Ontario than is at present the case.

(1) Lawson on Geology of Lake of the Woods.

Silver

There are no silver mines in Quebec except the silver recoveredfrom the Copper mines of the Eastern Townships.

In On tario silver was first found in 1846 in the Animike rocks of Thunder Bay. The first veins noticed were along the coast and on islands south-west of Fort William. Spar Island had been slightly developed before 1866, but the deposits were regarded as Copper until the first silver was recognized in that year. The discovery of the Thunder Bay vein in 1866 inaugurated the era of mining of higher grade silver ores. Futher developmeqt brought to light other veins, chief of which, was Silver Islet. These mines were worked until about 1875. Silver Islet continued in operation until 1884. Renewed activity commenced with the discovery of silver veins at Rabbit Mountain also belong to this time.

Silver mining proper has been confined to the Thunder Bay district. The rocks are Laurentian Huronian and lower Cambrian. The silver veins are found, with one or two excettions, in the lower division of the lower Cambrian rocks. The chief area is south-west of Port Arthur. It is roughly triangular in shape extending about 40 miles along the lake shore, 60 miles along Pigeon River, and 80 miles along the western side. The Animikie division is divisible into two parts, an upper and a lower, without a distinct preponderance of siliceous rocks of cherts and jaspers accompanied by ferruginous dolomites. The upper division has soft black carbonaceous argillites. The silver veins are mostly confined to the lower division. The silver ones are native metal and sulphides or aigentites, generally associated with blende, galena, pyrites etc., in a calate gangue in a series of fissure veins/.

There are five groups of veins (1) coast group, (2) Port Arthurgroup, (3) Rabbit Mountain group, (4) Silver Mountain group. (5) Whitefmish group.

The coast group comprises a series of veins on coast and islands from Port Arthur to Pigeon River and in Thunder Bay . The Silver Islet vein is the most important in this region. It is situated on a small rocky island a mile out in the lake, off Thunder Cape. Here in 1868 Thos. Mc. Farlane discovered silver ore in large nuggets and smaller disseminated particles. He worked with crowbars and obtained the first shipment of 1336 lbs. of ore. The metallic contents of the vein were native silver, argentite, galena, blende, copper and iron pyrites; also tetrahedrite, domeykite, niccolite, and cobalt bloom. Two new minerals of compoundsof silver were found called huntelite, and animikite. These, with mcfarlanite, formed the principal silver producing ores during the latter years of the mine. The native silver is generally disseminated throufgh the ore in more or less dendritic masses forming nuclei for the depositsof niccolite and sulphurets.

X (1) Mining on Lake Superior by Elfric Drew Ingall.

The vein splits, in crossing the island going south, but comes to gether both in length and in depth at the fourth level. After which it continues as one vein 8 feet wide. Combustible gas and mineral water were met with in the lawer workings of the vein.

Mc Farlane and his men worked at the vein during '69 and '70 and took out about $16000 worth of silver. A company of New York and Detroit Capitalists then got control of the mine and continued operations. The vein was found to be subject to sudden changes in size and richness. The company built breakwaters and solid cribbings and greatly enlarged the surface of the island. The damage wrought be storms during the winter months involved the expenditure of large suns, and this, with the very variable nature of the ores brought on, at times, great financial embarrassment.

The first bonanza was struct in 1873. It extended 100 feet on the hanging wall of main vein and nearly the same distance on the east vein. It yielded over $2,000,000.

From '74 to '78 nothing but exploratory work was done. The second bonanza was struck in1878.It was found while drifting, south of the third level. The first signs were impregnationsof graphite which were followed by the bonanza. It was cone shaped with base fifty feet wide at the third level and apex at the fifth level.

Work continued with varying success until 1884 without striking rich ore in any quantity. The main shaft had now reached a depth of 1160 feet. Work was suspended in March. In all about $3,500, 000 was taken out.

Other islands that have veins are Angus, McKellar, Thompson, Spar, Jarvis and Victoria.

The Port Arthur group has veins in pAminikie and in Archean rocks. Most of the veins are in the Animikie. The chief vein is the Thunder Bay. It was discovered by Peter McKellar in 1876 and this commenced the second era of mining activity in Thunder Bay region. Other mines in the Port Arthur group are the Duncan and Silver Harbour.

The Rabbit Mountain group was discovered by Oliver Daunais, a trapper and explorer. The first vein discovered was at the present Rabbit Mountain Mine. This discovery renewed activity again. This group differs from the other in being farther south of the northern boundary of the lower siliceous division, so thatnits veins occur in the upper argillaceous division. The rich ones are sent direct to smelters, the lower grades being treated in stamp mills erected for the purpose. Other mines are Porcupine and Beaver.

The Silver Mountain group is in the argillites surmounted by traps Mines are Palisades, Scripture, Silver Hill and Silver Falls.

Whitefish Lake group has veins containing blende, galena and pyrite in a calcite gangue. The rocks show the division of Animikie, into upper or argillaceous and lower or siliceous divisions. These are surmounted by traps. The mines are Sunset Lake vein Medicine bluff etc.

The veins of this region show similarity in direction of strike and in mineral constituents. The vein filling in general consists of quartz, barite, calcite , and fluorite constituting the basis of a gang in which occur the minerals blende, glena pyrite and some sulphurets and copper. Silver occurs as Argentite and in the native state, the former being more common.

Silver Islet vein is exceptional in that it carries arsenic and antimonial ores of silver with compounds of nickel and cobalt, not found in the other veins. The predominance of native silver in its richer parts was also unusual.

During recent years the silver mines of this region have been confined to West End Silver Mountain Mine south west of Port Arthur.

The silver ores of this region traverse the slates of the Animikie formation. In the new silver mines of Coleman township near Temiscaming Lake the region is similar. The lodes occur in slate breccia and have not been found to extend down to the underlying formation. The assemblage of minerals including cobalt, arsenic and nickel is also similar, though the development of these is greater in Coleman. The veins here are narrow but very rich and may even surpass the Silver Islet vein in Production. All the silver mined inxk 1904 came from Coleman, save a small quantity extracted from Sudbury nckel copper matter.

Nickel.

(1) The nickel producing regions are the Sudbuty deposits and the Lake Temiscaming Cobalt-nickel-asenides. These are situated about 90 miles apart and though both pres contain nickel they are otherwise different in character. The Sudbury deposits are contained in a sheet-like mass of eruptive rocks, forming a basin or short synclinal trough enclosing sedimentary rocks, which seem to rest on this eruptive sheet. The whole depression was probably an ancient lake bottom and the Cambrian sedimentary deposits are ancient silt beds accumulated on the lake bottom. The sheet itself rests on Archean rocks. It is a laccolite sheet of gigantic size. In its lower, or basic side the nickel deposits are found. All writers agree that the Sudbury ores are of igneous origin, i.e. the nickeliferous magnetic pyrites or pyrrhotite and copper pyrites have separated from a molten mass of rock. The deposits at Cobalt on the other hand occupy narrow vertical fissures and joints which cut through fragmentary rocks of lower Huronian. The mineral in these veins has been deposited from highly heated impure waters.

The Sudbury ores are remarkable in that they sontain no less than seven metals:- nickel, cobalt, silver, platinim, copper, and palladium are saved, while two others, one a metal, iron; and one a non-metal, sulphur, are eliminated only to be wasted.

(2) The nickel industry at Sudbury is increasing its output , and already surpasses the output from New Caledonia the only other nickel producing country in the world. The matte is shipped to a refinery at New Jersey. The mines are practically controlled by the Canadian Copper Company subsidiany to the Intercolonial Nickel Co. which owns the only refinery in America. This enables them to keep up the price of nickel, thus retarding its free use in the arts. What is needed is a Canadian Co. to go into the field to refine as wellas smelt. It is reported that the government is taking steps to bring this about.

Thos. A. Edison's experts have been testing the northern part of the eruptive sheet with magnetic instruments, but he has not begun developments on any of his locations.

The Lake Superior Power Co. began operations on the Gertrude mine chiefly on account of its sulphur contents. They intended utilizing the sulphur (which comprises about 25 per cent of the ore) in the manufacture of sulphude pulp, and reducing the roasted ore to ferro-nickel to be used as an alloy in the production of steel rails. The high percentage of copper afterwards encountered inthis deposit necessitated a change of plan anf the ore is now smelted by the ordinary processed used in the district.

(3) Dr. Ludwick Mond F. R. S., inventor of the carbon monoxide process of separating nickel from copper is at the head of an English Corporation owning three mines and a smelter in this region.

(1) The Cobalt-nickel Arsenides of Lake Temiscaming by Willet G. Miller
(2) Report of Bureau of Mines of Ontario 1905.
(3) Canadian Life and Resources." Feb. 1906.

The richest mine now in operation is the Creighton, owned by the Canadian Copper Co. The ores are rich and can be worked by open quarrying. Since locating this mine the company have ceased raising ore from the mines at Copper Cliff, as they were more expensive to work and leaner in nickel. They were, however, richer in copper and platinum. The platinum seemed to be greater or lesser in amount according as the Chalcopyrite was greater or lesser in amount.

In 1903, the Sudbury district saved 636 ozs. of platinum from the nickel matte. This will likely now decrease in amount as the Canadian Copper Co. is working its Creighton mine which contains less platinum than those at Copper Cliff. Platinum occurs as an arsenide in the mineral sperry-tite. Palladium also occurs in perhaps the same state as it is found in equal quantities with platinum. This mineral is coming into greater use constantly, as it can be used in some cases instead of platinum, the increasing scarcity of which makes this necess ary.

The Sudbury region also produced Cobalt formerly, but latterly both the Canadian Copper Co. and Mond Nickel Co. have put in Bessemer Converters to convert the low grade matte into a higher grade. Nearly all the cobalt is blown out along with the iron, and wasted, since cobalt oxidizes at an early stage in the blowing process. So the production of cobalt from this time will likely cease at Sudbury.

Copper and nickel are the principal minerals produced.

The water powers on the Spanish river are being developed to transmit power to operate the works at Copper Cliff twenty-eight miles away. This plant just completed by the Canadian Copper Co. at a cost of $700,000 is considered the finest of its kind in Ontario.

The ore deposits of the Sudbury region were known to the Geological Survey for over half a century. This knowledge was of little economic value until the C. P. R. opened the county north of Lake Huron. The surveyors in 1862 re-discovered pyrrhotite deposits, and preliminary assays revealed the presence of copper in the ore. Because of this content prospectors explored the district and in 1885 the Murray mine began to be worked for copper. The ore was shipped to the Vivian Brothers smelters of Swansea, Wales, and there the metallurgists discovered a nickel body of even greater value than the copper and since then the mines have been developed chiefly for nickel and copper.

Silver Cobalt Ores.

The cobalt-nickel-arsenides and silver deposits of Lake Temiscaming were discovered a short time ago, during the construction of the Temiscaming and Northern Railway. The situation is only four miles from Lake Temiscaming which has been traversed for 200 years. The factthat these ore bodies were never before discovered shows the great possibilities there are for the finding of other ores in the vast unexplored region of northern Ontario.

The ores of this region may be classified as follows,-
Native elements,- Silver, Bismuth, Grafhide.
Arsenides,- Niccolite, Chloanthite, Smaltite.
Arsenates,- Erythrite,(or cobalt bloom), Annabergite (or nickel bloom)
Sulphides,- Argentite and Millerite.
Sulph Arsenide,- Mispickel (or sulph arsenide of iron)Cobaltite.
Antimonide of Silver.
Sulph Antimonide, Pyrargyrite, Tetrahedrite.

These deposits are similar to the Port Arthur silver deposits in that they both occupy vertical fissures which cut slightly inclined rocks of pre-cambrian times. They are similar in mineral contents, as cobalt-bloom with nickel-bloom and arsenides were found in the Lake Superior area. The Port Arthur deposits contain a higher percentage of gangue material; the ores occuring in bunches and pockets and the percentage of silver is always much higher than that of nickel or cobalt. In Temiscaming veins a much smaller amount of gangue is found; but the percentage of nickel and cobalt is usually much higher than that of the silver. Some veins show as much as 14 inches of smaltite and niccolite and very little gangue.

The only worked veins of the world that closely resemble the cobalt veins are those of Joachimsthal in Austria and Annaberg in Saxony. Nearly all the chemical groups of minerals found in the Joachimsthal region are present in the cobalt deposits. The chief exception is the mineral uraninite the source of radium, which has become very valuable. The Austrian government has forbidden the export of this mineral. It is believed to be found in the mica deposits of Quebec.

A similar assmeblage of minerals to that found at Cobalt was found a few years ago at Michipicoton Island. Native silver also occurs with native copper in the Michigan copper mines of the south side of Lake Superior. So it is probable that more deposits will be found between Cobalt and Port Arthur,500 miles apart.

The veins of the cobalt region are all similar in character. Most of them have been developed in from open cuts. One of the largest, first discovered, and most systematically developed is the La Rose claim. Ore to the value of $1,000,000 has been blocked out. It has a shaft 80 feet deep and 250 feet of drifting.

The most important veins are found in Lower Huronian rocks and occur in 3 parallel bands, although the veins do not have the same strike. The veins are not wide. They vary from one to fourteen inches in width.

The

The veins do not appear to cut into the Keewatin which underlies the Huronian. In some places the Huronian rocks are 500 feet in thickness in other places the Keewatin forms the surface rocks.

At present the cobalt ores are shipped to New York for refining. The Canadian Copper Company are erecting a refinery for cobalt ores at Copper Cliff and it is probable that these ores will be refined there in future. A single car load of ore is sometimes worth $ 50?000 the chief value being in silver.

Iron.

(1) The forces that produced the great iron ranges of Mesabi, Vermillion, and Gogebic in Minnesota and Michigan were also at work in Ontario. Large deposits of first class ore has been located at Hunter's island north of the international boundary near Duluth. The Animikie, which is the supposed equivalent of the Mesabi range, stretches from Gunflint on the International boundary to a point east of Port Arthur. New deposits will probably be found in this. At Loon Lake the diamond drill has located large flat lying deposits of first-class hematite. The Hutton range north-west of Lake Wahnapitae is similar to the Vermillion range of Minnesota. It contains large deposits of magnetic ores The iron formations on the shores of Lake Temagami showing banded magnetic outcroppings are also similar to the Vermillion range. Other promising locations are being constantly reported from northern Ontario, not the least of these, being near the Hudson Bay water-shed, and now almost inaccessible; but with the new railways being developed it will soon be open to the prospector and miner. Carbonate of iron or spathic ore is reported from Grand Rapids on Mattagami reiver, and specular ore and magnetite, and banded hematite all seem to be found at Round Lake on Blanche river.

(2) The iron resources of Ontario have been considerably augmented dur ing the past five or six years by the discovery of the following deposits,- (1) Michipocoten range on the east shore of Lake Superior. This is a hematite deposit and contains the mines, Helen, Josephine, Frances and Brant Lake. (2) Hutton or Moose Mountain range north east of Lake Wahnapitae where the ores are magnetic (3) Lake Temagami ranges including those on the north-east arm of Ko-ko-ko lakes , and on Vermillion and Iron Lakes. The ores are magnetite banded with Jasper show ing a little hematite. (4) Flying Post, or Ground Hog river range, of banded magnetite and hematite. (5) The banded hematite belt of Black Sturgeon lake south-west of Lake Nipigon. (6) Extensive ranges of intey banded hematite and jasper from the east shore of Lake Nipigon to Little Long Lake- 70 miles.

(1) Iron ores of Ontario by Thos. W? Gibson.
(2) Bureau of Mines of Ontario 1904.

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Workable deposits have been located at the Helen, Josephine and Frances mines in Michipicoten of which the Helen is the greatest producer in Ontario at present. It produces 1000 tons of ore per day and had produced over 1000,000 tons in 1904. Its ores are hard and find an excellent market in the United States for mixing with their soft ores. Much ore is also sent to the Company's furnaces at the "Soo".

The Loon Lake deposits have also been recently developed. The important possibilities of all these deposits have been recognized by a company of railway and iron Capitalists, who are erecting a blast furnace at Port Arthur to reduce thes ores.

The large though lean deposits of Mattawin rangeand also the Hunter's Island hematite and the magnetite of Hutton townsnip are being developed.

Excellent magnetite is found at Radnor mine, Renfrew; and in Mayo township, Hastings. The Radnor mines are owned by the Canada Iron Furnace Co. which ship their ores to Radnor, Quebec for smelting.

Although development is progressing rapidly there is food ground for the belief that many valuable deposits of iron ore are yet undiscovered in Ontario.

Iron pyrites mines are worked at Madoc, near Bannockburn, and at the Helen mine. The product is sent to Cleveland and Buffalo for the manufacture of Sulphuric acid. The magnetic sands of the north shore of Lake Superior are being worked by the North Shore Reduction Co. The sands exist along the shore both above and below the water, also in cliffs and river beds. Much experimenting had to be done with new machinery to deal with wet sands.

Copper.

(1)

Reference was first made to the copper of Ontario by Gen. Baddeley in 1830. The Bruce mines ore veins were discovered in 1846. Development was commenced by the Montreal Mining Co. and later taken in hand by the West Canada mining Co. of London England in 1855. They continued operations until 1875 when the low price of copper caused them to suspend operations.

During these early years other deposits were found. The chief of these were the Wallace and Emerald mines on Lake Huron; the Bagley, Palmer and Point Aux mines on Lake Superior.

(1) Bulletin on copper by R. W. Ells. L. L. D.

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1) Copper.

Reference was first made to the copper of Ontario by Gen. Baddeley in 1850. The Bruce mines ore veins were discovered in 1846. Development was commenced by the Montreal Mining Co. and later taken in hand by the West Canada Mining Co. of London England in 1855. They continued operations until 1875 when the low price of copper caused them to suspend operations.

During these early years other deposits were found. The chief of the these were the Wallace and Emerald mines on Lake Huron; the Wegley, Palmer and Point Aux mines on Lake Superior.

The continued success attending mines on the south shore, led to the exploration of St. Ignace and Michipicoten islands, but the lowprice of copper caused all operations to cease for some years.

(1) Bulletin on copper by R. W. Ells. L. L. D.

At present most of the copper mined in Ontario is produced by the Sudbury nickel mines. Yet other non-nickeliferous mines are being developed, although their output is not yet very large. These are, on the north shore of Lake Huron, the Massey and Herminia mines near Massey station on the "Soo". Branch of C. P. R. the Superior and Rock Lake also on the north shore; and the Tip Top mine west of Port Arthur. Patterson Prospect is also a new copper mine 136 miles west of Port Arthur on the C. N. R. The Bruce mines have been making shipments from the old dumps to the Sudbury smelter. The Rising Sun and Copper Queen are new mines about 30 miles north of Bruce mines.

Other mines are the Ransom near Dam Creek siding, Algoma Central R. R. Mines are worked at Parry Sound on Spider Lake. A new copper region called Whiskey Lake Copper area, is being opened. It is 15 miles north of Cutler station on C. P. R. The veins are very extensive.

Copper pyrites has been discovered in the Coe Iron mines near Eldorado station in Hastings County.

The Massey and Herminia, the Superior and the Tip-top are on sulphide deposits. An Elmore oil concentrating plant has been installed at Massey mine, the first of its kind in Ontario. Its workings are satisfactory. Its process is peculiarly fitted for the saving of finely disseminated copper sulphides, such as are found in the Massey veins. This process may bring many low grade prospects into market. A smelter is proposed to be built at Sault St. Marie.

The Tip-Top Copper mine has a shaft 300 feet deep. The ores are iron pyrites and copper pyrites. A find of white ore containing cobalt was made in this mine. The company propose erecting a smelter which would aid in developing the copper deposits in the neighborhood.

Zinc and Lead.

1) Zinc and lead deposits are being worked in Dorion township and McTavish township, surrounding Black Bay, Lake Superior. The rocks are Cambrian and Huronian sandstones, limestones and marls, separated by areas of gneiss. Quartz veins follow the fault lines. The quartz matrix of calc-spar and barytes carries galena, blende, and copper pyrites The deposits are somewhat pockety but veins are sometimes 25 feet wide. Ore was in early days taken out and shipped to the United States. Lead mines also occur near Bannockburn, Hastings County.

1) Annual Report of Section of Mines 1902.

Zinc is found near Long Lake Frontenac County, Near Nipigon Bay Lake Superior, and at Calumet Island Ottawa River. Lead is also found at Calumet and at Temiscaming.

G R A P H I T E

(1) Graphite has been known to exist since 1846 in the Laurentian mountains north of the Ottawa river in Quebec and in Ontario. It is found chiefly in the Crystalline limestones of the Grenville series.

In Quebec the Chief deposits are in the townships of Buckingham and Lochaber, Ottawa county, and the township of Grenville, Argentenil county.

Graphite occurs as disseminated flakes in gneiss and limestone and in true veins, columnar and foliated, which are often found cutting granite and other igneous rocks. The flake variety is due to organic remains.

In Lochaber and Buckingham there are wide deposits. They have been mined intermittently since 1846. The granite carries several other minerals such as scapolite, hornblende, pyroxene, pyrite, apatite, etc. The veins are often of great purity but their uncertain character is against their economic exploitation. A vein is sometimes 2 or 3 feet thick but soon breaks up into smaller veins or dies out. The mill product was not uniform in character some parts being excellent and others poor. The demand soon fell off. There is abundance of ore of very pure quality, but the loss of market is due to lack of care in preparation.

It has been established that the graphite from North Ottawa is eminently suitable for all purposes for which graphite is usually applied excepting the manufacture of fine lead pencils.

In Ontario graphite occurs near the Ottawa river, in Westmeath township, and north of Kingston at Mud Lake, Loborough township. Later finds are at Elmsley one mile north of Olivers ferry on Rideau Canal. At this point probably the first graphite mining was carried on. It occurs here in the Grenville limestone. The mines lay idle for years until 1902 when operations were again commenced. New mines were opened and large amounts of pure graphite found.

The ore is hauled 3 miles to the mill where it is roasted to drive off water, crushed to a uniform half inch size, and then ground by millstones after which it is separated into four grades by screens. This is the dry method and is is all automatic. Quebec uses the wet method by which the graphite is crushed under water.

(1) Bulletin on Graphite by R. W. Ells.

The presence of graphite in New Brunswick was noticed in 1839 near St. Stephens. It occurs as a stratum of plumbago or black lead near situated between perpendicular strata of schistose rocks.

This stratum was opened and supposed to be coal. No mining has been done for years. This is in Charlotte county and in the same county near Dumbarton station on the C. P. R. graphite slates are found in sandstones of the Upper Silurian.

On the shores of the Bay of Fundy near Bells Basin, Lepreau Harbour, there is a deposit of graphitic anthracite which was mined for coal over 25 years ago. Shafts were sunk to a depth of 140 feet.

The band was reported to be 20 feet thick in places. The coal burned rapidly under a forced draught. These deposits resemble those of Massachusetts and Rhode Island which have also been mined for fuel but with poor results. When crushed and properly separated, however, it furnished a mineral of considerable value. mThe Charlotte county, graphite might also prove valuable if treated in a similar way.

The best deposits in the province occur near St. John City on the St. John river. It is found here in crystalline limestones possibly Laurentian age. They appear to correspond closely with the limestones of the Grenville series north of the Ottawa river, which also contains graphite beds.

The St. John deposits have been mined at intervals since about 1850. The thickness of the bands vary greatly and the graphite is often associated with pyrite which breaks away easily leaving the graphite pure. Tests made in England gave the result that the Canadian graphite was not equal, for pencil-making and electrotying, to the graphite obtained from Bohemia and other places.

The portions best adapted for mining occur in bands of aggillite or slaty schist, through the ore is disseminated. The bands vary in width from one to four feet. The product has been used for foundry facings and in the manufacture of paint; but for higher grades its value has never been demonstrated.

The proper milling and grading of graphite is a very important feature as regards its market value. The failures to mine the Canadian ores are probably due to bad methods of cleaning and separating the final product. There is a large amount of ore in this region and, with more suitable treatment in mining , profitable returns should be made from capital invested. Other points in New Brunswick which have graphitic deposits are near Dorchester on Thorn's brook in North eastern Kings county.

Other deposits occur at Madawaska river near High Falls, in Marmora township and in Denleigh township Addington county.

The only other deposit being worked is the Black Donald mine in Brougham township. The deposit is large but as it contains calcite the ore is sent to the mills in Ottawa for chemical treatment. The development of this mine was retarded by a break in the roof of the mine under the lake.

Apatite.

(1) Apatite is found chiefly in Quebec. It occurs in two forms, or in two different surroundings viz: (1) In crystalline rocks of the Laurentians (2) In fossiliferous strata of the Cambrian or Cambro-Silarian in the Ottaw and St. Lawrence valleys. These latter are found in phosphatic nodules in limestone shales. It was thought that properly treated they would form valuable fertilizers for certain soils in Quebec ~~xxxxx~~ and in Ontario. But the abundance of the mineral apatite, in Quebec north of the Ottawa river, and in the eastern part of Ontario forms a more convenient fertilizer and no attempt has been made to develop the phosphatic nodules.

Apatite was discovered at Little Rapids on the Lievre River, Quebec in 1829, and in North Burghes township in Ontario in 1847. Mining commenced in Ontario in 1860 and in Quebec in 1871. The output increased until 1889 when the ewploitation of more cheaply mined phosphate of Carolina and Georgia led to the closing of operations in Quebec.

The most valuable deposits are in the Grenville rocks, and comprise a comparatively small area. The ores are pockety and in irregular veins. Some mines were followed down several hundreds of feet. The apatite is found associated with pyroxine intrusion and seems to have no connections with the limestones. It is concluded to be of intrusive origin. Thus the deposits are likely to continue to great depths.

In some mines in both Ontario and Quebec ~~xxxxxxxx~~ it is associated with mica. The Crystals in such mines were often too small to pay for extraction.

The districts in which apatite is found in Ontario are:(1) North Burgess between Rideau Lake and the town of Perth. (2) In Renfrew County. (3) Near Kingston.

Corundum.

(2)

Gorundum is found at Raglan in Renfrew County and at New Carlow in Hastings County. The Canada Corundum Co. operates at Raglan. They made special arrangements with the government and got control of extensive corundum deposits. They have worked out the problem of seperating the corundum from impurities such as feldspar, hornblende, and magnetite. They are experimenting to produce aluminium from corundum. This was one of the conditions of the agreement made with the government. Aluminum is at present made from bauxite although the percentage of aluminium in corundum is higher than that in bauxite. The usefulness of the Canadian deposits of corundum would be greatly increased by the success of this experiment. The sole use made of these deposits at present is for the manufacture of abrasives such as emery wheels etc.

(1) Bulletin on Apatite by R. W. Ellis, L. L. D.
(2) Reports of the Bureau of Mines of Ontario, 1904, 05.

Mica.

1) Ontario and Quebec form the leading sources of mica on this continent. The variety is phlogopite, or amber mica. The flexibility and resistance of this to the passage of electricity renders it particularly adapted to the manufacture of electrical appliances. India and the United States produce mica but the variety is muscovite or white mica. The amount being mined in Canada is decreasing. This is due to several causes: (1) The manufacture of micanite by which the smaller and formerly worthless portions of mica are being built up by shellac into boards that can be cut or bent into almost any shape, while its insulating power is almost equal to mica. This has caused the working over of the old dumps in the United States and decreasing the demand and price of the larger samples. (2) As electric companies are the main consumers of mica these companies are getting control of the mines. Their needs govern the amount produced each year. One of these, the General Electric Co. of the United States, controls the chief mines of Ontario and Quebec. Operations in Quebec were suspended in 1903; IN Ontario the sole producers are the mines near Sydenham, Frontenac county and near the town of Perth.

The mines in Quebec are situated in Ottawa county. These mines are mostly open quarries, but someunderground work is done. The mica undergoes a first preparation at the mines and is then sent to trimming factories in Ottawa. Amber mica is shipped to England. Muscovite mines also exist in Quebec but are not worked. The discovery of radio-active minerals in these mines is attracting attention, and they will probably be worked in the future.

Feldspar.

Feldspar comes from Bedford township Frontenac county, being mined by open cuts. It is also found in Templeton township Ottawa county, Quebec. The chief use is for glazing pottery, and the chief market is the potteries of New Jersey and Ohio.

Other minerals of minor importance.

Infusorial earth is found along the north bank of the St. Lawrence in Montmorency, Portneuf, Maskinonge and Montcalm counties in Quebec.

Molybdenite is found in Quebec in Megantic, Saguenay, Ottawa, and Pontiac counties; and in Ontario in Addington, Carleton, Frontenac, Haliburton, Hastings, Leeds, Renfrew, Victoria, Nipissing, Rainy River, and Thunder Bay counties.

Tungsten is found in Simcoe county, Ontario, and in Beauce county, Quebec.

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(1) Bulletin on Mica by R.W.Ells, L.L.D.

Manganese is found in Magdalen Islands, Gulf of St. Lawrence and Amherst Island. Wad is found in limited quantities in several parts of Quebec.

Marl.

(1) Marl was formerly prized as a fertilizer. It is now used, mixed with a proportion of clay, in the manufacture of the best grades of cement. Large manufacturing plants have been established at Marlbank, north of Bellville, and at Strathcona north-west of Napanee. It usually occurs in marshes and generally contains shells of various species of fresh water mollusks. Although belonging to the present geological age it often is not recent in formation, being overlaid at times with peat beds. At other times the marl covers the bottoms of lakes and ponds and is evidently in process of formation. It appears to be formed by spring water charged with lime, held as a bicarbonate, which is deposited on coming to the air.

The deposits are numerous on lake bottoms all over Ontario. They are also numerous over Quebec but not so extensive as in Ontario. Anticosti has good deposits.

Marl is used to manufacture such articles as, lime, white-wash, whiting for cleaning metals; and for the production of carbon dioxide in soda water.

Salt.

(2) The salt area covers about 2500 sq. miles between Kincardine and Lake Erie and extends eastward from Lake Huron about 40 miles. The deposits had their origin in the evaporation of saline water. The deposits must necessarily contain impurities. Such as sulphates, and chlorides of calcium, potassium, and magnesium.

Water is pumped into bore-holes and pumped out again as brine which contains 35% of salt. It is then evaporated by heating in pans.

The salt used in the fisheries along the Atlantic sea-board comes from England. This is not because we have not abundance of supply in Ontario; but because salt can be more cheaply produced at Cheshire, England where coal for evaporation is convenient. Cheap freight across the Atlantic can also be had.

The deposits of Ontario are found in the Onondaga and Salina formations which usually contain salt. These deposits were discovered in 1866 while boring for oil at Goderich. The Salina is overlaid by Devonian. At Goderich the salt beds aggregate 123 feet in thickness. Some of the individual beds are too impure for mining. Itis probable that salt underlies the southern part of Lake Huron and St. Clair River as the deposits are found in the Michigan side also.

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(1) Marl deposits of Ont. Que. N.B. and N.S. by R.W.Ells L.L.D.
(2) Annual report of Section of Mines, 1902.

The processes used in Ontario salt wells are similar to thes in use in Michigan and may be divided into two classes ~~xn~~ according to the manner of evaporation of the brine. These are; (1) evaporation in vaccum and (2) evaporation of the brine. The former is the better as crystallization is more rapid and a finer grain is formed. The lowering of air pressure causes evaporation to take place at a lower temperature than it otherwise would. The Canadian Salt Works at Windsor use this mthod.

Their well is 7 inches in diameter and is cased with air-tight tubing. A 4inch tube is enclosed in the well. Water is forced into the well by a powerful pump and the brine is forced up the inner tube. The brine is heated in open vats for a time in o order that the sulphate of lime may be deposited. The clear brine is drawn into vaccum paris which have three steam-tight compartments. Brine passes from the lower by heat and expansion through the central where the steam is contained in copper tubes. The salt precipitates at the bottom and is removed by a double valve without interrupting evaporation.

Petroleum.

(1) Oil production has been chiefly confined to Lambton County although oil has been known to exist in Manitoulin Island since 1860. Indeed some claim that the first oil discovered in Canada was found there. The drilling operations in Manitoulin in 1865 were unsuccessful but operations are in progress at present which promise better results.

Oil was discovered in lambton county in 1862 a few years after the great oil strikes in the United States. Lambton has had 10,000 wells about 8100 at Petrolia, and 1000 at Oil Springs. The remarkable thing about this field is the permanency of the flow and the small average yield per well. One group of 100 wells produced only 150 barrels per month.

Oil was also discovered in Essex County, Township of Dutton seven years ago. The field is small and the wells are shallow with steady flow. Oil is found in the Carniferous division of the Lower Devonian at 400 feet depth.

In Kent oil was found in 1902. On flowing well, the Gurd Gusher being struck. Few of the wells were productive. In Zone township near Bothwell a better producing fiel was struck. It has small production per well but the depression is small being only 2 per cent in 1905. In Euphemia north of this is another group with shallow but productive wells

Essex county long noted for natural gas bids fair to become an oil producer. A company boring for gas near Leamington struck oil in 1902. It was found in the Guelph of the Silurian formation was although oil was not believed to be found in Ontario below the corniferous . The Guelph a porous dolomitic limestone, is the producer of natural gas. In 1905 some large flowing wells were struck. The Hickney No.4 for three days produced 1200 barrels per day. It now produces 200 but is still flowing. Others have acted as an offset to the steady decline, during the past ten years of the oil production of Ontario.

Another new field was discovered in 1902-03 near Brantford. Gas was struck first which gradually gave place to oil. Several small producing wells were brought in. The formation is the Medina of the Lower Silurian.

Ontario does not supply Canada with more than half the petroeum she uses. The refineries at Sarnia and Petrolia have to import crude oil from the United States to keep their works in operation. Still there may be more oil in Ontarioathan is supposed. The Trenton of the Cambre- Silurian so prolific in oil in Ohio and Indiana underlies the whole of the south- western peninsula. It is at a great depth and expensive to reach. Some wells have been drill to it by the Imperial Oil Co. but without success.

(1) Bueau of Mines Of Ontario 1904-05.

Natural Gas.

The Essex field, so longe a prolific source of gas, has now almost (1)ceased to produce. The supply to Detroit was out off in 1901. And now hardly enough is obtained to supply the neighboring towns. Seven wells were recently struck in the Leamington oil district. These produce 5000 feet per day.

The first well in the Welland field was struck in 1889, seven miles from Port Colborne, Bertie township, in white sandstone of the Medina. There were a few small producers in Colborne since 1886. Seven wells were put down by the Provincial Natural Gas and Fuel Co. 30,505,000 feet per day is produced. They supply Buffalo, Niagara, Chippewa and other smaller towns along the lake.

In Winger field, Wainfleet township, eight producing wells were struck in 1903 in Clinton formation of the Lower Silurian.

The Mutual Natural Gas Co. controls a field near Port Colborne supplying it and other towns.

In Haldimand County, Canborough township, other wells supply 50,000 feet per day. They supply Hamilton and Dundas. It is called Otterclliffe field.

(1).Bureau of Mines, Ontario, 1904-05

Division 3.

Prairie Section.

(1) In the eastern part of Manitoba we have the flanking rocks of the Laurentian System. These are the Trenton and Hudson River in the Red River valleys, of which out-crops are seen at Tyndall. West of these Salvia and Niagara are found. The Niagara outcrops at Stonewall. Salina runs from Manitoba Lake south-eastward through Starbuck to Rosenfeldt. This contains salt springs, and the gypsum beds of Lake Manitoba are also found in this division. The Devonian comes next and extends to the Pembina escarpment from which west tothe Rockies the formation is cretaceous.

The only minerals found are the limestones of Stonewall, salt of Salina, which is not worked, gypsum beds, operated at Gypsumville at the head of Portage bay Lake Manitoba, and the Coal, Natural Gas, and Petroleum of the Laramie which is the upward continuation of the Cretaceous.

COAL.

(2) The most eastern coal deposits are those of Souris river and Turtle Mountain. This region in South-western Manitoba and South-eastern Saskatchewan has several seams of lignite which constitute an almost inexhaustible supply. At Estevan three seams are noticed, an upper of 4 feet, middle of 6 feet, and lower of a series of seams parted by fire clay.

The Rocke Percee and Coal Field Mines are worked by an adit tunnel from Souris River banks. The seams are about 8 feet thick. The Mines are well equipped with air compressors, coal cutting machines etc. They can turn out 600 tons per day.

In Turtle Mountain several coal seams were found on its northern flank several years ago, but no active mining operations are carried on. This region is separated from the Souris River coal field by a synclinal in which no coal is found.

The Belly River Coal fields extend from the Southern Boundary of Alberta northward 150 miles to Red Deer. The thickness and quality of the seams vary. On the Belly River and the lower St. Marys a length of outcrop of 18 miles may be considered workable. An important colliery, equipped to produce 1000 tons per day, is in operation at Lethbridge. Coal is mined at other places to supply the local demand. The coal is lignitic.

(1) Dawson's Geology of Canada.

(2) Section of Mines 1902.

The Cascade Basin is a region north-west of the Kananaskis Range in the Bow River valley. It contains about 60 sq. miles. The region is much disturbed. Many faults exist and some seams are almost vertical. All dip south-west. The coal is mostly bituminous, but some has been losally changed to anthracite. The chief mines are Marsh's Mine at the south end of the region, and Canmore and Anthracite mines on the main line of the C. P. R. At Anthracite three seams producing Anthracite are worked. At Edmonton coal is worked for local uses.

The Blairmore-Frank coal field is a region on the east slope of the Rockies, from Crows Nest Lake eastward eighteen miles, and from the 49th parallel northward an unknown distance. A section of this field gave 740 feet with 21 seams of coal of an aggregate thickness of 125 feet. No work was done prior to 1900, but itsdevelopment has been very active since then. This region will probably become an important factor in the fuel supply to British Columbia Smelters. Mines are operated at Frank, Lille, and Blairmore.

(1) Petroleum and Natural Gas.

Petroleum and Natural gas are known to exist over a great part of the Coal area of the prairie section. Oil wells are being developed by the Western Oil and Coal Co., These are situated near the International boundary 40 miles south of McLeod in Alberta. The Company propose to make McLeod their main distributing point and intend building a pipe line from the wells to that town. They are operating three wells at present.

Natural gas is found at Medicine Hat.

Iron ores exist east of Edmonton. A Company is developing these deposit-

Division 4.

Rocky Mountain Plateau.

As the minerals of this region are somewhat complex they can best be taken by districts. These are, beginning at the north:(1) Yukon, and in British Columbia(2), Cariboo, (3) Cassiar, (4) East Kootenay, (5) West Kootenay, (6) Lillooet, (7) Yale, (8) Vancouver, (9) Coast.

YUKON.

(2) This region is chiefly noted for its placer gold mines. Mining operations have been in progress since 1887. The great inrush of settlers took place in 1897 after the rich discoveries on Klondike Creek. About 60,000 miners rushed to these new diggings which were said to be the richest the world had ever seen. Dawson City was founded and soon became a thriving town. Gold production reached its greatest value in 1900 when it was over $22,000,000. Since then it has been declining, although, altogether, over $100,000,000 has been taken out. As hydraulicing and improved methods are introduced to work the poorer gravels it will likely increase again. Quartz veins will likely be found which will give rise to lode mining.

(1)Canadian Life and Resources, Jan. 1906.
(2)Section of mines, 1900, 1901, 1902, 1903.

Platinum is also recovered from the placer mines.

This region also has coal areas. Lignites and lignitic Coal occur in the Tertiary rocks of the Yukon valley and the Klondike river valley. There ar workings on Coal Creek, 20 miles from Dawson. Outcrops are found 50 miles below Dawsonon Cliff Creek, and as outcrops also occur between these places it is estimated that the area exceeds 200 sq. miles. Coal is mined at Cliff Creek and shipped to Dawson for heating purposes. It is also used on river steamboats.

British Columbia.

Cariboo District.

(1) The Cariboo district contains the Ominica and other divisions. It is the north-eastern part of British Columbia and comprises 60,000 sq. miles. As yet mining has been confined to an area of 2,000 sq. miles lying between the two arms of the Fraser river. This region can be divided into two parts: (1) That with altitude above 4,000 feet, (2) That of lower altitude than 4,000 feet. The latter is the old pre-glacial valleys and plateaus with the larger old river channels that cut them, such as the Quesnel river valley. The elevations as well as the valleys are roughly the same as in pre-glacial times. The sands in the valleys are the heavier condensed parts of rock containing gold and other substances too hard for disintegration. The streams mainly have their source in Mount Agnes. The fact that the streams have been confined for ages to the same channels accounts for the richness of their gravels. These are represented by the Quesnel river deposits and those of its tributaries, the Willow and the Cottonwood rivers.

In the Quesnel section it is estimated that $300,000,000 worth of gold exists allowing 10 cubic yds. of gravel to produce $1.00 which is less than the average produced by the Consolidated Cariboo Hydraulic Co. It is however, diluted with great quantities of gravel, andthe only possible mode of recovering the gold is by hydraulic mining.

The chief hydraulicing concern of this district isthat of the Consolidated Cariboo Hydraulicing Co. Its works are at Bullion, 4 miles from Quesnel Forks. It has a lease of about 10 miles of auriferous deposits on ancient river systems. Their water system comprises 33 miles of canals leading from the Lakes Bootjack, Polly, and Morehead. These deliver 5,000 miner's inches at the mine under a head of 420 feet. The lakes have been converted into efficientstore-houses by damming their outlets. Still in dry years they do not furnish sufficient waters and other lakes are being tapped, so as to insure a supply independent of weather conditions. The gold waving appliances consist of a double extended system of souices 7 feet wide and 4 feet deep and 2380 feet long. These are paved partially with wooden blocks, and partially with steel riffles. New steel riffles and fixtures are being installed for a new improved system of under-currents to recover fhour quicksilver, fine gold, platinum, and osmiridium. The plant is fitted with electric lights, telephones, and all modern conveniences.

(1) Review of Mining in British Columbia Bulletin, NO. 19.

The Ominica division is north-west of Caribpo and comprises the area drained by the Peace river tributaries, Salmon and Nechaces rivers. The mining area is around Ominica, Germansen, and Manson rivers. It is an area of about 50 miles diameter. This district has been worked by whites and Chinese since the early seventies, and now contains some larger companies. The most important of these is the 43rd. Mining and Milling Co. This Company acquired a lease in 1895 on Mansen and Slate Creeks. They have spent over a fourth of a million in opening up the districts by roads etc.

The coming of the G. T. P. has led to activity in prespecting. All speak highly of the country round Manson as being rich in silver, lead, and gold. Some free-milling gold-quartz is found in Peace river district. Coal is reported in large seams on the Parsnip river and also between Manson and Ominica. The region has not been well explored yet.

Cassiar District.

The Cassiar is the most northerly district in British Columbia. It embraces Skeena, Atlin and Bennett Lake, Teslin, Liard and Stikine divisions.

Skeena division has few placer mines. On the Estall, a stream flowing into the Skeena estuary, was found the first iron pyrites noticed in B. C. It is clean and suitable for the manufacture of sulphuric acid. Coal deposits, iron areas, and copper-gold ores are reported from the Bulkley valley. Lack of transportation facilities at present keep these in an undeveloped state. At Kitselas Canon some development has been done on quartz ores which carry values in bornite and copper pyrites, galena, and silver. Similar deposits are worked at Kilimat, and Observatory Islet. About 20 miles from the head of Portland Canal rich ores have been found. It is expected that this region will develop into an important camp.

The Princess Royal Islands and Queen Charlotte group both have mines producing ores which are sent to smelters in Crofton, Vancouver Island. The earliest discovery of placer gold 1856, was on Moresby Island, one of the Queen Charlotte group. Coal and iron are found on Graham Island, and asphaltum occurs on Ramsay and other adjacent small islands.

The history of Atlin division is recent. Two prospectors, Fritz Miller and Kenneth McLaren, discovered gold on Pine river in 1898. For a year or two as much as $800000 was produced per year. But the richer deposits have been worked, and the placer miner is giving place to the company with hydraulic operations. Drifting and tunnel methods are carried on, and where practicable hydraulicing and dredging has also been tried. One very complete dredge outfit has been installed.

The hill east of Atlin contain well defined fissure veins, carrying sulphides of iron and lead and small quantities of copper. Native copper has been discovered south of Atlin Lake. Another mineral district lies near Taku Arm, the mineral being galena, iron copper pyrites, gray copper and native gold.

The North-eastern Cassiar includes the mining division of Teslin, Liard and Stikine. The Stikine river was worked by placer miners in the sixties and seventies. In 1872 the rich deposits of the Liard basin were discovered by Thibert and McCullough. The Thibert, Dease, and McDame creeks yielded large quantities of gold prior to 1880; but thereafter the production declined rapidly. Hydraulicing operations commenced in 1903 on Thibert and increased the production. Other propositions are in progress and when machinery can be ~~xxxxxxxxx~~ placed in this region at any reasonable cost large profits will be returned from the gold deposits. Osmiridium is known to exist in the gravels of the Thibert but it is not saved by the hydraulicing Company in operation there.

East Kootenay.

This district includes Fort Steele, Windemere and Golden mining divisions. The Fort Steele division contains the most productive areas at present, having the Crows Nest Pass coal fields, and four important silver-lead mines, St. Eugene, North Star, Sullivan, and Estella. There are numerous partially developed prospects of much promise in Fort Steele, Windemere, and Golden.

The East Kootenay was opened in 1864 by placer miners at Wild Horse Creek, which flows into Kootenay at Fort Steele. The deposits were rich, ordinary claims yielding $20 to $30 per man per day. In 1866 they were abondoned except by Chinese. In the seventies the coal areas of Crow's Nest Pass were noticed. In 1888 the first quartz mining was started but no important discoveries were made until the North Star mine was located in 1892. In 1897 the Crows Nest Pass railway was commenced and operations on the coal mine began, 10,000 tons being banked out before the railway reached the mines. Hydraulic mining has recently been inaugurated.

Fort Steele division has six mining sections:
(1) The big coal bearing area of Crows Nest Pass.
(2) The North-east section, which is little prospected.
(3) The east-central, wheremuch work was done in former years, the most important mine being the Estella. In one cross-cut, three feet of clean ore and 15 feet of concentrates are showing. It waits transportation facilities.
(4) The South-eastern section which has ores of copper pyrite, malachite, and bornite. Coal and oil occurs in this division and the Country is being prospected.
(5) The South-west section includes the Moyie Country. The St. Eugene mine on Moyie Lake is the largest lead producer in British Columbia.
(6) The West-central section includes the productive lead mines, North Star, and Sullivan. A smelter is being erected. These mines have transportation facilities as have the mines of the fifth section.

(1) The Crows Nest Pass Coal field is immediately west of the Rocky Mountains. It is triangular in shape, with base to the south where it is 13 miles wide. It extends northward 35 miles. It covers an

(1) Coal fields of Crows Nest Pass by E. Jacobs.

area of 230 sq. miles; and as the seams aggregate 100 feet of workable coal it is estimated that 22,600,000,000 tons of coal are contained. Coal was discovered in early years, but development started with the building of the Crow's Nest Pass railway.

The coal is bituminous and occurs in cretaceous rocks. No coal is found in the Carboniferous of British Columbia. The Carboniferous rocks here are of limestone and are marine in character. As British Columbia has all varieties of coal from lignite to anthracite. It is evident that the harder varieties of coal are the result of metamorphism rather than of age.

Mr. Wm. Fernie commenced to prospect along with Lieu-Col. Baker in 1887. They succeeded in having a bill passed, in the British Columbia legislature, authorizing the construction of British Columbia. Southern R. R. to develop this coal area. Still nothing was done for ten years, when the British Columbia government arranged with C. P. R. to build the Crows Nest Pass R. R. which was completed 1898.

The Crow's Nest Pass Coal Co. acquired control of the coal lands. The first operations were at Coal Creek, about 4 miles east of Fernie. Then mines were opened at Michael 25 miles farther northand then at Morrissey Creek farther south.

Coal Creek has 6 mines on 4 seams, the largestbeing a 30 foot seam of soft coal. Michael has 6 mines on 6 seams and two more being developed. Morrissey Creek has five mines. One half of the total production of coal is converted into coke. There are 424 coke ovens at Fernie, 464 at Michael and 240 coke ovens at Morrissey. They produce 1500 tons per day. The time of burning is 60 or 70 hours. No provision is made to save by-products.

Two railways the C. P. R. and G. N. R. branch from Jennings giving the collieries railway communication with the smelters of British Columbia and Washington which are their chief customers.

The silver-lead mines commenced operations in 1896. They produce two-fifths of the lead mined in the Dominion. Half of the silver and lead mined in the Fort Steele division comes from St. Eugene mines. This St. Eugene Co. owns three group s of mines on the east side of Moyie lake. These are the St. Eugene , Moyie, and Lake shore groups. The St. Eugene has 5 miles of underground works. Its ores have 38 to 50 ozs. of silver and 63 to 67 per cent of lead to the ton.

The North Star was the first lode mine worked on a large scale in this division, being located in June 1892. Since 1900 the mine has had railway facilities. Over 40000 tons of ore has been shipped; but the big and clean body of galena and accompanying carbonates has been mostly worked out and there is no other ore in sight.

The Sullivan group is located on March Creek near Kimberly. The ore is low in silver and, as the price of lead is low, only small shipments have been made. A large body of ore, chiefly galena with a large percentage of iron, has been exposed. A smelter is being built near Kimberly.

Windemere Division has a mineral belt 45 miles long and 25 miles wide. It extends from Findlay Creek to Salmon River. Findlay Creek had placers years ago, and a few quartz claims have since been located. A mill has been erected on the Thunder Hill group. It has been idle for some time.

The Golden division comprises the northern part of East Kootenay. It is traversed by the C. P. R. main line. A little development has been done on the argentiferous galenaand blende deposits near Field. There are many prpmising lode claims on the south of the C. P. R. but want of Capital has retarded development. There are mica deposits near the Big Bend of the Columbia. Some ore has been packed out.

West Kootenay District.

This is the most important district in British Columbia for the production of the leading minerals, gold, silver, copper and lead. It sends out about three fifths of the total of these ores mined in British Columbia. The main districts are Nelson, Trail Creek, Slocan, Ainsworth Trout Lake, Lardeau etc. Their characteristic minerals are not generally similar. In Nelson gold prevails, although there are important deposits in which either copper or silver predominates. Rossland mines as a rule produce gold and copper. The Slocan is noted for silver and lead, with zinc becoming an important by-product. The Trout Lake division has gold for its most important metal in parts, while in other silver and lead yield the chief values.

The West Kootenay reduction plants are well to the fore. Trail smelters are the best in British Columbia. There the Canadian smelting works treat copper and lead ores and produce pig-head and refined silver There are also smelters at Nelson and Pilot Bay; while at Ymir the largest stamp mill, supplemented by a cyanide plant, in the province is situated. There are numerous concentrators in the Slocan, some equipped for saving zinc as well as lead concentrites. In Lardeau near Ferguson a twenty-stamp combination silver mill has lately commenced work, while a later installation is the big concentratorof the Rossland Co. at Trail. Then there is the Elmore oil process plant at Rossland, not large but the first of its kind in Canada. Ithas demonstrated the practicability of treating the low

grade ores of Rossland that will not pay for shipment to the smelter.

The Nelson division is one of the oldest in the province in which lode mining for precious metal s has been carried on. It lies between the Columbia river on the west and the Kootenay on the east. It includes several mineral belts of considerable area and extent, and distinct characteristics. These are (1) The free gold of Morning Mountain near Nelson, (2) The copper-silver deposits of Toad Mountain. (3) The mineral zone-chiefly gold-of Ymir and Erie camps. (4) The silver, lead and iron sections in Goat river division south of Kootenay Lake.

The Silver King claim was the first located. It was accidentaly discovered in 1886. The ore yield values in silver and copper. Its smelter, built in 1895, treat customs ores also, chiefly silver-lead ores.

The Morning Mountain has numerous mines, Venus, Juno, Star Group May, and Jennie. The ores are quartz carrying gold, a little silver, and copper.

The Ymir comprises a number of groups of claims along Salmon river, in Wild Horse canon, on Dundee Mountain, and on Porcupine Creek. The Ymir mine in the Wild Horse is the chief property. The ore is quartz mineralized with iron, lead, and zinc sulphides. Its gold saving plant is the largest in the province.

The Trail Creek Division was opened by the Dewdney trail in the sixties. The iron stained cappings of this district attracted attention; but the ore being low grade no development beyond a few prospecting holes was done for 25 years. In 1889 Jos. Bourjouis located the first claim and in 1890 he located the Centre Star, and War Eagle. He and his partner also located the Le Roi but being forbidden by law to stake more than one claim on the same vein this passed to Col. Toping, afterwards known as the father of Trail, who merely paid the expenses of recording. He afterwards sold one-half of his share for $30,000.

The War Eagle and Centre Star were developed about 1895. The War Eagle showed at first a big body of pyrrhotite, but then too low in grade for economic working. Another vein of gold ore was found at a later stage which placed the mine among the best in camp.

Smelters were built at Trail and a branch railway was extended from Butte to the Le Roi mine in 1895.

The most notable feature in the geology of the district is the prominence of igneous rocks. The auriferous iron and copper sulphides occur almost exclusively in the massive members of the eruptive series. The most common Rossland ore is pyrrhotite or magnetic iron ore. It contains gold and silver in very varying quantities. The pyrrhotite

is generally accompanied by chalcopyrite or copper pyrites. Molybdenite occurs at some of the mines and is sometime highly auriferous. Galena and blende occur outside the main area but not in the REDMountain mines which constitute the most important district. This district contains the great mines of Le Roi, War Eagle, and Centre Star which have a record as early dividend payers among British Columbia mines. The high grade ores are giving place to leaner ores as depth progresses necessitating more economic working.

The Slocan division is about 12 miles wide and 18 miles long. It is mountainous and is covered with clay slates termed Slocan slates. These have many intrusions of eruptive rocks. The whole area is disturbed, the bed being greatly tilted and faulted. The ores contain, besides spothic iron ore and quartz, a variety of silver-bearing minerals. An important part of the ore is highly concentrated and can be shipped with little picking as a clean ore.

The main ore at present produced is galena carrying values in lead, zinc and silver. It also has sulphur combined with lead and zinc.

In the Slocan are such mines as, Payne, Slocan Star, Ivanhoe and Monitor. Several of these having concentrators have had them altered to save the zinc.

The Slocan City division is called the "Dry ore belt". The Arlington, Black Prince, Ottawa on Springer Creek, and Enterprise on Ten Mile Creek are the most important mines. The most striking feature of recent development is the large low-grade ores of Springer Creek. Although these contain shoots of high grade ore, yet in the main the ores are too low grade to ship and smelt. Experts, however, announce a metallurgical process for the economic treatment of these ores; and in the event of its being installed the future of this district should be bright as its ores would run high in tonnage.

The Ainsworth division contains the following mineral locations: (1) On Kalso Creek; Province, Cork, Bismark and Silver Glance. (2) On Woodbury Creek; Baltimore and Black Eagle. (3) On White Mountain; The Whitewater, Highland, and Highlander. The Highland is a low grade silver ore but it is one of the oldest mines in the province. The Highlander has a big body of concentrating ore. A fine shoot of zinc ore running 29 per cent zinc and 60 per cent of silver was encountered. The concentrating and mining plant is operated by a water system having a head of 1075 feet, probably the greatest in the province. The Blue-Bell was the earliest discovered mine in British Columbia.

The Lardean division extends from Upper Arrow Lake northward to the Big Bend in the Columbia river. In this region are contained Fish River Ferguson Camp, Trout Lake district, and Poplar Creek Camp.

The region is mountainous. The summits of tilted sedimentary rocks tower 10,000 feet in height harbouring, in the high basins and, on the divides, glaciers and perpetual snow, affording scenic effects of great beauty. Near the summits have been found silver galena deposits.

The Lardean has long been reconized as a mineral bearing area, and claims were located near Comaplix 1888. Early finds were also made about Ferguson and Fish river. The region has not received the notice from prospectors that its indication should deserve. The find of rich gold ore on Poplar Creek has drawn attention to it however, and now it promises to become a regular producer of gold and silver.

In Ferguson Camp the Silver Cup mine is situated. It has produced blocks of tetrahedrite as large as 18 inches in diameter. The ores of the region are quartz, heavily mineralized with tetrahedrites, galena, blende and copper and iron pyrites. The most picturesquely situated mine in the province, the Triune Group, is here located. Its tunnels run into the face of a cliff under a glacier.

The Poplar Creeks is the name of Lardean river basin below Trout Lake. In 1903 Marquis and Gilbert discovered rich showings of native gold here. This caused a fush of miners and numerous claims were staked on the neighboring creeks. The most remarkable vein was the Lucky Jack, which showed some of the best specimens of native gold found in the province.

The Revelstoke division takes in the North-west Kootenay and the Big Bend region, so called from the sharp bend taken by the Columbia river in passing through the Selkirks. The Big Bend was the scene of active mining operations about 40 years ago, when it had a population of about 10,000 and about $5,000,000 worth of gold was taken out. For years the region was practically deserted but in 1886 active operations commensed on Mc. Cullock and Frank creeks about 50 miles north of Revelstoke. This section is now worked by hydraulicing and placering. Some of the hydraulicing propositions have had as much as $100,000 expended on them.

Some lode mining has been done in the district north of Revelstoke on veins producing copper pyrites with values in silver and gold.

In the Illecillewaet division east of Revelstoke lode mining has been done at Waverley and Lanark mines. The minerals are gray copper and gale galena with values in gold, silver, and copper.

The Lillovet District.

This district lies between Yale and Cariboo and comprises the drainage basins of the Fraser and north Thompson rivers. In the early sixties placer mining was carried on, and later hydraulicing, lode mining, and dredging. Over $1,500,000 worth of gold has been taken out. It is divided into two mining divisions Lillovet and Clinton. The former is the more important containing mining camps on the Fraser, Cayvosh Creek, A Anderson and Blackwater Lakes and Bridge river with its tributaries.

The Clinton division contains Bonaparte river, Big Bar on the Fraser, and the North Thompson. Mining in this division is now unimportant, being confined to a little placering and hydraulicing at Big Bar.

The Cayvosh division has quartz and placer mines. Quite a lot of gold was taken from the stream but bed rock was not reached. Rich free-milling quartz was located in 1894 but not much success has attended efforts at quartz mining.

The Bridge river division was prospected during the times of the Cariboo placer mining. Good diggings were struck on the south forks of Bridge river. Gold quartz was stnuck in 97 on a tributary of the South fork. The Little Joe, Ida May, Lorne and Woodchuck Claims are located here.

Two hydraulicing companies are operating under joint management on the north fork of Bridge river. They have expended $40,000 in equipment, fluming, pipe-line etc.

The Iowa Lillovet mining Co. secured a lease for hydraulicing 3 miles of the Fraser river. In 1903 they constructed a dredge which is working satisfactorily giving 40 ozs of gold per shift. The gravels and sands of the bars, channels, and terraces at Lillovet all carry gold in quantities to justify the installation of a dredge. The amount of material is large enough to keep a dredge busy for 20 years.

Yale District.

The chief mining divisions of the Yale district are (L) the Boundary (2) The Sunilkameen (including the Okanagan country). (3) The Kamloops (including Ashcroft and Yale mining divisions).

~~The Boundary is the mineral production of the province.~~

The Boundary is the only division that has yet contributed largely to the mineral production of the province. The Similkameen lacks transportation facilities, and its extensive area of minerals will not be developed to any great extent until these arrive.

The poineers of the Boundary were the placers miners who worked Rock Creek and Boundary Creek in the early sixties. In 1884 Camp Mc. Kenney had its beginning. In 1886 and 7 mineral was located near Boundary falls, and what is now Copper Camp. In the early nineties the great mines of the present time were located. These were, Mother Lode, Old Ironsides, and Knobb Hill, of the Granby group. Some high grade silver was sent out but not much development was done until 1896-7, when the Granby and B.C. Copper CO. initiated their big enterprises. This opening up induced the C.P.R. to extend their Columbia and western railway into the Boundary. Since then ore production has been carried on on a large scale; the total tonnage of the district going considerably over half that of the entire province.

The ores of this group are divided into 3 classes viz: (1) The lowgrd grade large copper-bearing sulphide deposits, remarkable for their great size and lack of surface oxidation or alteration. Pyrrhotite, Chalcopyrit and pyrite are the chief minerals of this class. (2) Oxidized Copper ore (3) The small gold and silver beating quartz veins. The minerals of this class are chalcopyrite, pyrite, arseno-pyrite, galena, zinc blende, tetrahedrite and silver.

The low grade ores are self-fluxing, as they contain enough silica-in iron ores and lime to keep furnaces in good order and slag loses within proper limits. The percentage of iron oxide ores to the whole ore body is sensibly diminished as the workings are deepenad.

These copper mines are interesting to mining men on account of the unusually large size of the ore bodies, with attendant low cost of mining, and the generally favorable nature of the ores for cheap smelting. The chief mines are the Granby, Mother Lode, B. C. and Snoeshoe.

The Granby group consists of ten claims near the town of Phoenix. The surface debris was removed and ore 400 feet wide was exposed. Mining is carried on both by quarrying and under ground stoping. The Granby mine mines are typical of the Copper mines of this region, although they are the largest yet developed.

The Mother Lode is situated 3 miles west of Greenwood. Its ore-bodies are also large varying from 80 to 160 feet. Its output is about 1000 tons per day.

The Snoeshoe and B. C. groups are other paying mines near Phoenix.

Quartz veins with values in gold and silver are widely distributed on both sides of Boundary Creek around Long Lake, on both sides of the notth fork of Kettle river, and at Camp Mc. Kinney. They are being developed around Greenwood, and on the Boundary Creek, and in several instances returning profits. In the early nineties some ore was packed over the mountains and hauled to Marcus, Wash. Although the cost of mining and freight was over $30 per ton yet a good profit was returned to the enterprising pioneer lode-miners of the Boundry.

The most important mine is the Jewel, on Long Lake, which has shipped 3545 tons of ore and has thousands of tons blocked out on three of its levels. Around Greenwood the high grade concerns are the Providence Elkhorn and E. P. U.

The ores of the Providence mine returned an average value of $100 per ton during 1903. Now they are shipped without sorting and the value is less, but still the mine is paying well. The values are in gold, silver, and a little lead.

The Elkhorn is situated close to Greenwood. Its ore is quartz mineralized with galena, zinc blende, iron and a little copper. Values are chiefly in silver and gold.

The B. P. U. mines are south-east of Greenwood, several known veins exist but are all being developed. The quartz carries free gold and tellurides.

Camp Mc.Kinney is farther up the Kettle river. There will not be much development until railways arrive. Besides quartz veins there are bodies of rock mineralized with iron and copper.

The Vernon and Osoyors division have not much development yet. At Fairbank Camp in the Osoyors dixisionx several stamp mills are located. The chief mines are Stemwinder and Morning Star. The Stemwinder has been extensively developed. It has a stamp mill and cyanide plant of a daily capacity of 150 tons.

The Similkameen division stretches from Kruger Mt. in the east to Hope Mt. in the west, and from the International boundry northward 50 miles. About one tenth of this area has been prospected. There are numerous claims on outcrops of gold-silver-copper ores.

Around Copper Mt. south east of Princeton there is a mineral belt 3miles long and 2 miles wide. Enough prospecting has been done to show that this area is traversed by numbers of copper ore shoots, varying from 2 1/2 to 50 inches in width.

Opposite Copper Mt. on the west side of the Similkameen river is Kennedy Mt. on which a number of claims have been located, and shoots exposed large enough to be profitably worked, enecially as they carry good values in gold. mOn two claims platinum has been discovered in the ore. It averages from $2 per ton up to several hundreds of dollars per ton.

Near Eoche river are several small veins of high grade gold ore.

On the Tulmaleen and its tributary Bear Creek high grade copper ores are found.

Summit Mt. is situated on the summit of the Cascades. It has high grade galena veins with values of $100 per ton.

The Hedley copper and gold camp, 25 miles south east of Princeton, is the only one where continuous development has been done. This is the most important mining undertaking between the Boundary and the Coast. 4000 feet of work, mostly tunneling has been done. The Nickel Plate is the chief mine. Its vein is 80 feet wide. Gold is found in association with arsenal iron-pyrites, and a considerable proportion is usually free. Specimens have been found containing ten per cent of nickel, a little cobalt is found. The values in silver are low.

The division of Kamloops and Vicinity comprises Ashcroft, Kamloops, Nicola and Yale mining divisions.

In Ashcroft Indians and Chinese recover large quantities of gold by means of sluices and rockers from the bars of the Fraser and Thompson. A dredging Co. has a lease of 35 miles of the Fraser between Lytton and Lillooet. They propose building a new dredge with latest improvements.

In the Highland valley, mineral claims are attracting attention. The largest of these are in the Transvaal group with values chiefly in copper.

Kamloops district has its centre of activity at Coal Hill, three miles south of Kamloops. The ore is Chalcopyrite associated with magnetite or pyrite.

Coal seams have been found on the North Thompson; and at the head waters of the Thompson and Canoe rivers mica is found, although it cannot be developed until better transportation facilities arrive.

The Iron Mask group of mines is 6 miles south west of Kamloops. The ore bodies are two large lodes aggregating 100 feet in width and containing a vein of high grade chalcopyrite.

The Copper King group 16 miles from Kamloops has values in copper, gold and silver.

Glen-iron mine has shipped iron ore for several years to the Nelson smelters where it is used for fluxing purposes.

A mineral belt extends north west from Similkameen through Nicola country to Kamloops. There are several camps, Aspen Grove, Mill Creek, Ten Mile, etc., but there is little to induce developement as the region is without railways. Near Coutlee and Nicola Lake appears an area of coal seams.

At Yale Chinese bar-miners have operated on the river for years, but their number is diminishing and the gold yield is lessening. Two or three hydraulicing enterprises are doing well? Mineral claims are being developed at Siwash Creek.

Coast District

This district comprises the country from the International boundary 100 miles north and from the coast eastward to the divide between th Fraser and Lillooet rivers. It includes Texada and other islands east of Vancouver. Little is know of the minral resourses of this great district. Mineral claims have been staked near Mount Baker, around Harrison and Pitt Lakes and on streams flowing into Burrard Inlet on Howe Sound and on the Islands.

Those on Howe Sound and Texada island are the only claims receiving attention at present.

On Howe Sound the Britannica group of Copper gold claims have enormous masses of ore. The claims extend over 297 acres and cover 8500 feet.of lode which is 300 to 600 feet wide and impregnated with copper and ~~iron~~ iron pyrite. It is called Britannica mineral Zone and is estimated to contain three million of tons of ore. It has values in gold, silver and copper and may be worked by quarrying.

Texada island has small quartz veins carrying free gold in the northern part of the island. The commercial ores are those of iron and copper. The The large productive copper mines are the Van Anda group and Marble Bay group

The Van Anda operates the Cornell and Copper Queen mines. The ore is high grade and increasing with depth. 15000 tons have been sent to smelters at Crofton and Tacoma.

The iron deposits occur in the south western slope of the island, three four miles north of Gillies Bay. They all occur within a space of about a mile, along the side and base of the first range of hills which rise above the terraces forming the shore line. Some areas were taken up for iron mining in 1875. About 400 acres are now held by the Puget Sound Iron Co. On these only has any development been done.

The principal ore deposits are one mile inland from the wharf. The main workings are large quarries on the face of the bluff 600 feet above the sea. The ore is a clear magnetite mixed with rock, which is an altered diorite now epidote. Only the ore running over 50% iron was shipped in all 18000 tons.

Other iron properties exist in Gillies Bay. The chief of these is the Paxton and Lake mine. The ores are magnetite.

Vancouver District

Vancouver district has produced $56,000,000. worth of coal which is more than one-fourth of the total mineral production of the province. While coal is the principal mineral mined there, gold-copper-ores are also becoming important. About 20% of the copper produced in B. C. in 1903 came from Vancouver. The mount Sicker mines are the most important. The camp is situated in and above the valley of the Chemainus river, and includes the Western slope of Mount Sicker and the eastern slope of Mount ~~Sicker~~Brenton. the town and most of the mines are situated on Mount Sicker.

The principal mines are, Tyee, Lenore and Richard III.

The Tyee is a group owned by an English Company. Development has been confined to the Tyee mine, which has a big ore body containing values in gold, silver and copper. This mine commenced shipping ore to Ladysmith smelter in 1902.

The Lenore was the first property in the district to assume any commercial importance. It was prospected in '97 and a company formed for its development in '98.

The Richard III has big values in gold, silver and copper.

The Alberni division has been worked by Chinese placer miners since the early sixties, chiefly in China Creek where much flour gold was obtained. In the nineties numerous quartz mining ventures were engaged in, but lode mining was not permanently established as a paying industry. In recent years iron ore and promising bodies of copper have been found. The Nahamint Mining Company's property, called Hayes' Mine, was the first worked in '98 and '99. Its values were chiefly in gold, silver and copper. This mine and the Monitor are situated on the Alberni canal. The Monitor's ore is a high grade chalcopyrite. The Silver Cross and Cascade mines are situated on Uchucklesit Harbour. They are copper-silver-gold mines.

Among the iron deposits of this region, those of Sarita and Copper Island are prominent. The Sarita is situated on Sarita river. The iron out crops on a long ridge 60 to 100 feet high. Part of the face of the ridge has been cleared off and a showing of clear magnetite 60 feet high and 90 feet wide exposed. The ore is free from sulphur but contains a little calcite.

Copper Island rises abruptly from the sea to a height of 1000 feet. The iron deposits of this Island attracted attention in '91. The most important work has been done on Mountain claim. The strippings show a large mass of magnetite 40 feet by 70 feet in size. Magnetite is visible to the top of the hill.

The most important work in the Quatsino division are (1) The Ureka Copper Co. on the Comstock. (2) The June group with big showings of copper.sulphide. (3) Iron deposits on the north side of the west arm of Quatsino Sound. Limonite is found on eight claims and bog iron on five.

Iron is found in other divisions of Vancouver Island, viz: (1) At Sooke where a magnetite is found. This contains too much copper for economic mining. (2) At Port Renfrew also a magnetite is found. (3) At Nootka Sound.

Iron is also found at Queen Charlotte Island.

Coal is found at Nanaimo, Cranberry district, Comox district, at Quatsino Sound, Albert Bay on the north west coast, and at Sooke.

Coal is found at Nanaimo, Cranberry district, Comax district, at Quatsino sound, Albert Bay, on the north west coast, and at Sooke.

The fields here are perhaps, the oldest worked on the Pacific Coast seaboard, being in operation more than 50 years.

The Comox, and Nanaimo districts comprises a long narrow trough extending in three divisions from near Cape Mudge on the north-west to within five miles of Victoria on the south-east, 130 miles. On the north-east it lies beneath the Strait of Georgia, on the west it is bounded by a ridge of crystalline rocks, seperating the north-west Comox field from the south-east Nanimo field.

There are two seams in the Nanimo district, the Douglas and Wellington seams, which give steam and house coal respectively.

(1) The existence of coal was recognized on the Pacific Coast by Dr. W. F. Tolmie, an officer of the Hudson Bay Co., in 1835. In 1849 the Hudson Bay Co. brought miners from England and by 1853, 2,000 tons had been raised. San Francisco offered a market and the amount increased. The principal mine was at Nanaiom. By the end of 1888, four and a half millions of tons had been taken out, in 1891, over a million tons were raised in one year. California is still the cheif market, and this coal controls the market there, being of better quality than any other on the Pacific Coast. Smaller quantities are sent to the Hawaian Islands, China, Japan, etc.

It has to compete in the Pacific, with shipments brought out as ballast from Great Britain, also with coals from New Castle, New South Wales, and with coal fromJapan, and in regard to the Russian ports, with coal raised by convict labor at Duai, on Saghalien Island, Okotsk Sea. That it holds its own against all competitors is a sufficient guarantee of its quality.

The coals of British Columbia represent every stage, from hard smokless anthracite to soft lignite and brown coals. All belong to the Cretaceous or Tertiary age.

(1) Article of report of section of mines 1902.

The Nanaimo colliery originally included that portion of the field near Nanaimo harbour, underlying the harbor, the islands of Newcastle and Protection, the city and adjacent country. Other areas have been addad. The main shipping point is Nanaimo harbour where the company has wharves with a frontage of 2000 feet at which the largest steamers can load at all tide stages. A new pit head is being contemplated by which it will be possible to load coal direct from the mine to the pit, a thing unknown any where else in the world.

Shaft are situated in Nanaimo city, on Protection and Newcastle islands and at North field. This field is 200 square miles in area.

The Comox field is, according to Dr. Dawson, probably more extensive than the Nanaimo. Its area is 300 sguare miles without considering the seaward extension. Sections showing on Brown river display nine seams aggregating 16 1/4 feet in width. The Wellington Colliery at Cumberland town in the Comox field is operated by the Wellington Colliery Co. which operates at Nanaimo. The company manufacture fire-brick also, from fire clay extracted with the coal. At Alert Bay in the north a seam of anthracite has recently been discovered and is being worked.

The Queen Charlotte Islands field is in that part of the Cretaceous Which extends over Graham and Moresly Islands on both sides of Skidegate Sound. The coals are anthracite and bituminous, the former comparing favorably with that of Pennsylvania.

The Queen Charlotte Coal Co. constructed works at Cowgitz in 1871, and attempted to work the anthracite seams there. They met with poor success, however. The region has been greatly disturbed, the seams being often vertical. No doubt the disturbance changed the coal to anthracite. The best seam is over six feet thick.

Peat Bogs of Canada.

(1) The peat areas of Canada deserve notice although they are too numerous to individually specify. Peat is supposed to be a North German or Anglo-Saxon word meaning bog. We mean by peat the mosses of the genera Sphagnum Hypnum etc., when found growing together in a dense mass where drainage is imperfect. They die at the roots and increase upwards thus raising the centres of the bogs. The edge may die away and exhibit dead peat owing to drainage. As the life of the peat depends on its being saturated like a sponge with water and, as the water is dependent on rainfall, we have bogs most abuntant in the Maritime provinces near Hudson and James Bays. In the dryer central parts peat does not thrive so well.

The greater numbers of Canadian bogs belong to the pre-historic age, although bogs are found in the Maritime provinces under boulder-clay, and under 80 feet of marshmud. Some of the bogs around Northumberland Strait are ten feet below the level of high tide. As peat cannot live in salt w water it is inferred that these were formed when the land was somewhat higher than at present. It is probable that these commenced to form when the land emerged from under the sea in post glacial times. The more inland bogs are of greater age.

Nearly all Canadian bogs are still growing and increasing in depth. The bogs usually constitute three or four layers of different kinds of peat viz: (1) The yellowish, greenish or reddish living mosses in the upper part of the bog, a few inches in thickness. (2) The dead and dying roots of mosses which from a dark-brown spongy bed. (3) A blackish partially decomposed stratum more brittle than the last, having undergoon more decay, but still tenaceous enough to form turf. (4) A black layer of decomposed turf containing roots and trees more or less decayed.

In North America peat has developed best in a zone between the mean annual isotherm of 55 degrees, Farenheit, and the northern limit of trees. The Southern boundary is a line drawn from New Jersey west to Minnesota, there crossing into Manitoba and the Western provinces, and recrossing the international boundary in British Columbia. North of this limit there is an almost incalculable amount of peat, with its greatest development around and east of Hudson and James Bays, and in Ontario and Quebec. Peat is noticed as far north as the Churchill river. Immense areas are found in Northern Ontario, eastern Keewatin, and Moose river basin. It is found in Manitoba, Saskatchewan, Northern Alberta, and in British Columbia, also in the Yukon where it is called "tundras". In Manitoba the bogs are called "muskegs".

(1) Bulletin on Peat by R. Chalmers L. L. D.