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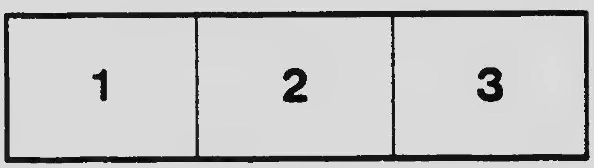

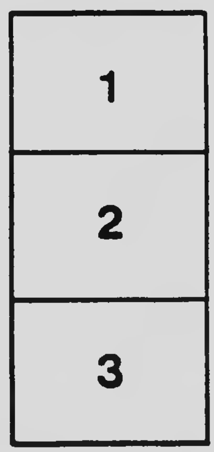

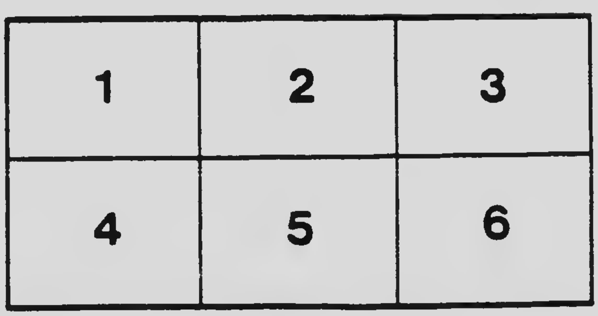

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Among the Mines in Canada.

BY

JAMES BARROWMAN,

MINING ENGINEER.

REPRINTED FROM "THE HAMILTON ADVERTISER,"

OCTOBER, 1908.

AMONG THE MINES IN CANADA.

JAMES BARROWMAN.

MINING ENGINEER

REPRINTED FROM "THE HAMILTON ADVERTISER,"
October, 1908.

To The Hon C. R. Devlin

With the Author's Compliments.

Stoneacre

Hamilton

This map shows in red the route taken by the Excursion, and the dates when the several places were visited.

AMONG THE MINES IN CANADA.

THE VOYAGE OUT

The Canadian Mining Institute having kindly invited members of the Mining Institute of Scotland to take part in their summer excursion to some of the Mining districts in Canada, extending right across the Continent from Nova Scotia to Vancouver, a few of the members left Glasgow on Saturday, 15th August, by the Allan Liner, "Hesperian," for Quebec, where they were joined by others of the party. In weather conditions most favourable, the good steamer passed down the Firth, halting for a short time at Greenock, and proceeding to Moville, where a few hours' stay was made. By noon on Sabbath the steamer was on the great deep, and ploughed her way westwards at the rate of about 380 knots per day. A smooth sea, a commodious and well appointed ship, and a company of most approachable and agreeable passengers, served to make the passage not only comfortable but delightful. There was an absence of some disagreeable elements that are so frequently associated with steamer travel, notably excess in drinking, and the sweepstake in connection with the daily run of the steamer, which is often an occasion for gambling and drinking, was not indulged in. A good number of the saloon passengers, including several clergymen, were on their return to Canada and the States, and all in the most kindly way aimed at contributing to the general comfort and enjoyment. Among the intermediate passengers was Mr J. Keir Hardie, M.P.

A service was held in the saloon on the Sabbath forenoon, and there were lectures and other entertainments on the succeeding evenings. The first lecture was by Mr Keir Hardie on "Socialism the Solution of the Labour Problem." The conclusions of the lecturer were that under the reign of Socialism the environment is to be so changed for the better, that the evils of human nature are to be eliminated, and moral worth is to be the standard. Mr Keir Hardie claimed for Socialism that it is to do for the twentieth century what Christ and his followers did for the first. A discussion followed, in which it was apparent that at least some of the audience were not satisfied that Socialism, without the infusion of love having its source in the divine, could effect the moral improvement aimed at. On the following evening a lecture on "Impressions of a [illegible] journey in Asia," was given by the Rev. J. Arthur Brown, D.D., who had been delegated by the American Board of Missions to undertake the journey and record the result. On a succeeding evening Dean Hart of

Denver lectured on some features of Christian science, with special reference to the value of suggestion in the cure of illness, to which he thought our medical men should give more sympathetic attention than they have hitherto done. On the following night there was a capital concert, in which saloon and intermediate passengers took part; and the series of entertainments was concluded by a lecture by President Eaton of Beloit College, Wisconsin, on "Wordsworth, and the English lake district."

Through the goodness of the chief engineer, an examination was made of the engines, running under a steam pressure of 180 lbs. per square inch, at 92 revolutions per minute, and burning 110 tons of Scotch coal per day. Asked if Canadian coal was not used, the chief engineer jocularly remarked that it was no good, as it produced 30 cwt. of ashes to each ton of coal. The somewhat unusual occurrence of a burial at sea took place, one of the passengers having died suddenly in mid ocean. Fogs delayed the passage considerably. The horn was frequently sounded, and the engines had to be stopped sometimes for hours on end. On the sixth day out, and within a day's sail of Newfoundland, an iceberg was passed about a mile from the steamer, in a bright morning sun. It appeared to be about 100 feet in height and 250 feet or so in width above the water, and when it is borne in mind that only about an eighth of its bulk was visible above water level, some idea can be formed of its great size. Within half an hour the fog had again fallen, and engines were stopped for a while. More icebergs were seen during the day, and in the late afternoon the Island of Belle Isle at the mouth of the straits of that name was sighted about a mile off. To the plain man it is a mystery how, after nearly 2000 miles of steaming, with no sun during the latter half of the way, and detentions and drifting from fogs, the ship should strike the proper course at Belle Isle, apparently with as much ease and accuracy as a Clyde steamer on a summer day finds its way between Garroch Head and Cumbrae. A night's steaming and the region of fogs and colds was past, and the day opened in sunshine and breeze, and the face of the Gulf of St. Lawrence rippled in gentle gladness. A day and a night, a great part of which was out of sight of land, brought us after passing the Island of Anticosti to Father Point, on the south bank of the St. Lawrence, there about 20 or 30 miles wide. In the next twelve hours from this to Quebec, ever changing panoramas were presented to the view on each side of the river. On the north bank ranges of hills recalled many a familiar scene in our own Highlands, while on the south the gently rising ground was dotted with houses within their own enclosures, stretching back into the wooded higher ground, and the villages with the ever prominent church. Islands in the narrowing river diversified the scene. A short stop was made at the quarantine station, two hours short of Quebec, then passing the Island of Orleans the good ship came into view of the Falls of Montmorency, 251 feet high, on the right, and ahead, glowing under the evening sun, stood Quebec, high and strong and stately.

CANADIAN HOSPITALITY.

The excursion, which must have entailed on the Canadian Mining Institute a vast amount of work in the preliminary arrangements, gave rare opportunities to those from Scotland who accepted their invitation of getting not only a general idea of the external features of Canada from sea to sea, but of acquiring a knowledge of many details in connection with the mining fields and mineral concerns visited. The kindness shown to the visitors at all hands, and the readiness with which every sort of information was given, were most gratifying, while the hospitality extended was lavish. The first contingent of the visitors were not many hours in Quebec when they were received by the Premier of the Province of Quebec, the Mayor of the City, and the Minister of Mines for that province; and when a few days later the coal mines of Sydney at Cape Breton in Nova Scotia were visited, the Premier, the Commissioner of Crown Lands, and the Lieutenant-Governor of that Province joined the party and took a lively interest in the proceedings. Right through the excursion, the Premiers of Provinces and other important Government officials lent their aid in giving the visitors a good time, and succeeded admirably. It was apparent that the Government were giving every encouragement to the various institutes represented on the party to get all the information possible on the mineral resources of Canada, with the view of having their riches and abundance more widely known.

THE COAL MINES OF SYDNEY.

These are on a scale of magnitude that we are not accustomed to in the old country. The Dominion Coal Coy.'s coalfield is 140 square miles in extent, and the output in July was 368,000 tons of coal; while the Nova Scotia Steel and Coal Coy. have a field of over 20 square miles, estimated to contain nearly 800 million tons. Already the workings of these collieries have extended a considerable distance under the sea. Thick seams, good roofs, no dislocations (only one slip of six feet in hundreds of acres of workings), moderate inclination, and little water to pump, give a set of favourable conditions probably unexampled in coal mining. Coal-cutting machines of the percussion and disc types are largely used. The daily output per man employed above and below ground is about $2\frac{1}{2}$ tons. The large scale of the operations here is illustrated by the method of winding at one of the Dominion Coal Coy.'s pits, where the coal in hutches containing two tons each is tipped at the pit bottom into tanks containing 6 tons or more, and so raised to the surface. Nor are the comfort, convenience, and safety of the workmen overlooked. Comfortable and commodious houses are provided, and the workmen are encouraged to become owners of their dwellings. There are washing houses at each pit, where the men can wash as they leave the pit and change their clothes, to get them clean and dry on their return in the morning. A life-saving station has been established at the Dominion

Coal Coy.'s collieries, where sets of the Draeger apparatus are kept, enabling the rescuers to enter among unbreathable gases in case of fire or other disaster involving pollution of the atmosphere. Suitable workmen are systematically trained by an experienced trainer, 50 out of 100 in training being competent to use the apparatus. Accidents are treated in the hospital connected with the city.

The Dominion Iron and Steel Coy. of Sydney have four blast furnaces putting out from 250 to 300 tons of iron per day from ore mined in Newfoundland, their fuel being purchased from the Dominion Coal Coy., in the form of coal and made into coke, and the limestone mined at Marble Mountain, Cape Breton. The product of the furnaces is treated by the Bessemer process, and made into rails, bars, rods, and fencing wire. It is amazing how great masses of glowing metal, first in the liquid state and then in great ingots, can be moved about by machinery and guided into and run through the rolls in gradually increasing length and diminishing thickness, emerging in an incredibly short space of time in the finished state. The coal used for smelting at these works is ground and washed before being coked, the washery being an immense building containing the machinery for effecting the necessary separation of dirt from the coal, capable of washing 240 tons per hour, and six great bins or reservoirs of 1100 tons' capacity each. The 500 Otto-Hoffman coke ovens produce 1100 tons of coke per day, also gas sufficient to heat the ovens and run the rolling mills and for other purposes, and tar and sulphate of ammonia. The slag from the blast furnaces, which has hitherto been usually a waste product, is here ground up with a mixture of the necessary proportion of lime, and made into valuable cement at the rate of 500 barrels a day.

It is pleasing to the Scotch visitor to see how dear Scotland and the Scot are to the Nova Scotians, the greater number of whom are either Scotch or of Scotch extraction. Gaelic is widely spoken. Sydney enjoys the distinction of publishing a Gaelic newspaper, and there is a church in the town where there are Gaelic services. While retaining many of the Scottish characteristics, the Nova Scotian has a frankness and easy courtesy of manner which those in the mother country would do well to emulate.

ASBESTOS AND CHROMITE IN THE PROVINCE OF QUEBEC.

In the face of a range of hills at Thetford and Black Lake, in the Province of Quebec, are situated the quarries and mines of the Asbestos Companies—great quarries hundreds of feet long, and from 50 to 150 feet deep, of rock like grey whin, with veins or streaks running through it in all directions not unlike dull, tough glass. The rock is quarried by means of power drills and blasting, and conveyed to bank by rope tramways. In winter, when weather conditions are severe, the working is carried on underground by mining.

The works of Bell's Asbestos Company and the Standard Asbestos Company were visited. There seems no limit to the depth to which the mineral can be worked. The veins may be mere streaks, or they may be several inches in width. The vein substance, although solid and glass like, can be picked or teased out with the fingers, yielding the white, fibrous, woolly material, so unmineral like, known as asbestos, which has the property that it can be woven into cloth and other textures which are indestructible from fire. Where the vein is comparatively thick, and the quality good, the asbestos can be separated without any difficulty from the parent rock, and picked out by hand with ease; but with the thinner veins an elaborate process has to be gone through before the product is ready to be manufactured. In that case, the rock as it comes from the quarry is taken to the mill, where it is crushed between great jaws or rollers, actuated by powerful machinery electrically driven, then raised by means of belt buckets to the top of the building, thence to pass through successive stages of separating screens and grinding machines, so as effectually to sift out the asbestos from the containing rock. Each shaking screen passes the small rock through its meshes, and the larger pieces and the asbestos are hitched along to the delivery end of the screen. Just above the delivery end there is a broad-mouthed pipe, through which a powerful current of air is sucked up, and this has the effect of taking up all the fibres of asbestos from the screen, on the same principle as the new carpet and house cleaning machines now coming into use. This operation of screening and collecting of the fibre is carried through many grades, till the asbestos in various degrees of length of fibre is all recovered. One of the mills visited is 120 feet long, 60 feet wide, and several floors in height, and passes 500 tons of rock per day. The uses to which asbestos is put are numerous, one of the most important now being the roofing and lining of buildings as a protection against fire. The qualities having the longest fibre are used for asbestos cloth and other soft fabrics, and the shorter fibre is mixed with cementing materials to form the sheets of various sizes for building purposes.

The works of the Canadian Chrome Company are in the neighbourhood of Black Lake. Chromite is a mineral of the appearance of black, somewhat lustrous whin, but more easily broken than whin. It occurs in irregular masses and veins in the surrounding rock, and is worked either opencast or by underground mining. The ore on being mined is taken to the mill, where it is crushed by means of stamps of the same kind as are used in the treatment of gold quartz, and then mixed with water and passed over vanners, which have a resemblance to shaking screens, by which the ore is separated from the barren rock. The concentrates so obtained are dispatched by rail to be further treated chemically before being used in various industrial processes, notably in the hardening of basic steel, the tanning of leather, and the manufacture of bricks for the lining of furnaces.

NIAGARA.

The impression made upon the visitor by his first view of Niagara will depend largely on the anticipations he has formed, as well as the mode of approach to the Falls and the atmospheric conditions at the time. A person of lively imagination will receive an impression that words cannot express, while one of phlegmatic temperament may have a sense of disappointment. Probably the best way of approach is by steamer on Lake Ontario from Toronto to Lewiston, about four miles below the Falls, where the Niagara River joins the Lake. From Lewiston up to the Falls the river flows through a deep gorge which has been formed in past geological ages by the action of the Falls upon the strata over which they have flowed. At places where the gorge is narrow, the quickly-flowing flood is lashed into foaming rapids, giving a foretaste of what will be seen later of the immensity and force of the volume of water from above. At no one point can the Falls be viewed in their whole extent and impressiveness; but much has been done to give the visitor every facility to see the great sight from every point of vantage. The lands on each side of the river have been acquired by the respective Canadian and American Governments, in order that they may be reserved as public parks, where all may come and go as they please, from point to point, without charge or fee of any kind. Even the policemen are instructed to be not only preservers of the peace, but attentive to visitors, ready to give all sorts of information and put strangers at their ease. For a dollar the visitor may travel a round route by electric tram from Lewiston up the gorge on the American side, view the Falls at all points on that side at his leisure, then cross the river a little below the Falls to the Canadian side, dropping off and lingering as long as he may at any point or number of points, rejoin the train by a later car, and then train down the river on the top of the bank on the Canadian side, completing the circuit at Lewiston. The train, running in either direction, may be joined or left at any station within the circuit, and at every point of vantage the visitor may stay as long or as short as he pleases. Without the aid of illustration it is difficult to place before the reader a clear conception of the situation of the American and Canadian Falls in relation to each other. Imagine a horse shoe lying with its open side towards you, the left limb of the shoe being three times longer than the other and bent a little outwards at where the heel in the proper shape of horse shoe would be. The Canadian Fall fills the bend and right hand side of the shoe, and the American Fall the third part of the elongated portion at its outer end. The volume of water of the Canadian Fall is much greater than that of the American. Under brilliant sunshine and with the best possible facilities for see[illegible] from all points, the scene at either Fall is most impressive, the [illegible] body of light blue-green water rolling majestically over and dashin[illegible] one great sheet of white 170 feet below, and producing a constant rising cloud of spray, through which a brilliant and perfect rainbow shines resplendent. Within the last 300 years, during which correct records have been kept, it has been proved that the Canadian Fall has been wearing back the strata over which it flows at the rate of 5 feet per year.

But this article was meant to be a description of another feature of

Niagara Falls, in some respects almost as impressive as that which has been described, viz., the works constructed for the harnessing of a portion of the force of these mighty waters as they roll over in majestic sweep. Within the last few years, on both the American and Canadian sides of the river, works have been established for the utilisation of the power of the Falls. The magnitude of these works the ordinary visitor has no means of knowing, as they are for the most part underground, and even the power houses, built above ground, while of large dimensions and fine appearance, cannot but suffer by comparison with the largeness all around of rock and flood. A short distance above the Canadian Fall are the works of the Electric Development Company of Ontario, Ltd. As a preliminary to the construction of the works here, a portion of the river above the Falls was dammed in so as to secure an even level and regular flow of water at all seasons and to prevent obstructions by ice at the point where the water is tapped. Entering the power house, one cannot but be surprised at the enormous scale on which everything is constructed. Imagine close to and alongside the river a great trench cut in the solid rock 500 feet long 143 feet deep, and 22 feet wide in the lower portion, and much wider towards the top. From top to bottom of this vast space, on floor after floor, are huge rapidly revolving machines in bewildering profusion. From a channel at the river side the water enters iron pipes of about 4 feet in diameter, which are carried down to great turbines of 12 or 15 feet diameter, which, revolving at immense speed, caused by the pressure of water exerted, and connected with electric machines, transform the power into electric energy available for all industrial purposes, and conveyed to the country all around up to 172 miles distant. Four turbines, each developing 10,000 horse power, have been erected here, and seven more are to follow. In a chamber about 12 feet in diameter, through the middle of which the great shaft of one of the turbine wheels passes from floor to floor, there is a beehive-looking casing about 4 feet in diameter, surrounding the shaft. Through little windows in its side you look in and see an electrically lighted space in which a light brown liquor is dashing about, and through the deafening noise the attendant shouts in your ear "This is how the shaft is oiled." After the water has spent itself in the turbines, it is carried by a great tunnel back to the river at the bottom of the Fall. The Ontario Power Company taps the water above the Falls and conveys it down past the Falls to the power house at the water's edge, so saving excavation. This Company has six turbines in operation, developing 65,000 horse power. The Ontario Government Niagara Falls Commission receives a royalty from the Power Companies, which is spent in improving and beautifying the neighbourhood of the river, with the view of making Niagara Falls convenient of access and a source of attraction to the nations of the world.

COBALT, THE SILVER CITY.

In the fall of 1903, the region of Cobalt, Northern Ontario, was virgin forest and lonely lake. Now, tree stumps and naked rock meet the eye everywhere, even in the streets of the town of Cobalt, which has sprung into existence as if by magic, occupying a picturesque site on the lake side. All around, in all stages of early development, are the erections connected with the numerous mines which have occasioned the rise of the town, and which are bringing to light day by day new treasures of silver ore, the value of which one can hardly describe without suspicion of exaggeration being excited. The mining area is in various concessions, which are sub-divided into lots of 40 acres. One Company may own one or more lots. The Company holding the largest number of lots, to the extent of 280 acres, is the Nipissing Company. The silver occurs in veins of varying thickness up to about 18 inches and even 2 feet. The silver is associated with cobalt, nickel, and arsenic ores in varying proportions. One of the largest mines in the district is named Coniagas, which is made up of the chemical initials of these four substances. The visitor is not left to the mere word of interested parties for information as to the richness of the ore. It is confirmed by the reports of the Government officials; but there is room for a large margin of error, to leave results that are astounding. The place is shown where, in the opening up of the railway passing through the district, the first vein was discovered. The vein is seen imbedded in the solid country rock on the surface of the ground, 4 inches wide, and so rich in native silver that a rub with the sole of one's boot polishes it clear. In La Rose mine adjoining, veins up to 12 inches in width have been proved, estimated at places to yield 9000 ounces of silver per ton of vein stuff. At another, called Lawson, an exposure on the surface up to 8 inches wide is seen, and shows native silver of great richness shining in the sun. The Crown Reserve mine, which has been proved to a depth of over 85 feet and more than 100 feet in length, has veins up to 2 feet wide. A shipment from this mine of 20 tons of ore yielded £18,000, and a heap at present in a shed at the pit top of about 8 feet by 8 feet by 6 feet is estimated to yield from 8000 to 10,000 ounces of silver per ton. This at 6 cubic feet to the ton and at the price of 2s per ounce, amounts to £57,600. An attempt to break off a specimen from ore of this richness usually results in failure, the hammer leaving its abrasive mark on the metallic silver in the mass. In the Toronto Exhibition there is a specimen on view from this mine weighing 1600 lb., one third of which is estimated to be solid metallic silver. It has been purchased by the Government of Ontario for £1000. Sheets of pure silver the size of a bootjack are not uncommon, and larger specimens are on exhibition at the mines. Much has yet to be done in the way of systematic working and treatment. In many cases only the richest ore has as yet been shipped, the less valuable grades being reserved for future disposal. At the Coniagas mine a concentrator has been erected, where the vein stuff under a certain grade is crushed, washed, separated, and prepared for smelting. All high grade ore of the Cobalt mines is being shipped to the smelters at Sudbury and Deloro in Ontario; New Jersey and Colorado in the United States; and even Swansea and Glasgow.

COPPER AND NICKEL OF SUDBURY, ONTARIO

The Sudbury district of Ontario is noted for its deposits of copper and nickel ores; and the magnetic iron ore of Moose Mountain, which has only recently been opened up and connected to port by rail, is destined to have an important influence on the iron industry of Central Canada. Something will be said later about this iron ore. Meanwhile the copper-nickel ore mines of Creighton and the Copper Cliff smelter, belonging to the Canadian Copper Coy., claim our attention. The deposit of ore at Creighton lies in a great mass or vein 400 feet wide lying at an angle of 72 degrees. It has been proved to be over 1000 feet in length and 500 feet in depth, and is excavated both by quarrying and underground working. The ore is raised from the quarry or mine to the crusher, where it is broken up by machinery and passed over picking belts and the useless material thrown out. The ore, as it leaves the crusher, is composed of from 2 per cent. to 4 per cent. of copper and 2 per cent. to 4 per cent. of nickel, and there are large proportions of other substances, notably silica, iron, and sulphur, which have to be separated out. The first part of the process is roasting in great heaps, a little wood being required to set off the fire, after which the sulphur in the mass is sufficient to keep it burning for months. The bare aspect of the country surrounding Copper Cliff, where the roasting takes place, proves the deadly effect of sulphur fumes on vegetation. The bins of ore and coke at Copper Cliff smelter hold 15,000 tons. The coke for smelting is got from Pennsylvania. The ore is to all intents and purposes self fluxing, only a small proportion of silica or lime being required, depending on the quality of the ore treated. Ore and coke in the necessary proportions are put into four furnaces taking 400 tons a day each. The product of these furnaces (called matte) in a liquid state, which now contains 35 per cent. of copper and nickel combined, is run into pots of 10 tons capacity, and taken to another building where the pots are caught up by a travelling electric crane, which, like a thing of life, carries them to Bessemer converters (large pot like furnaces swung like a hot-water kettle). Into these the contents are emptied as easily as a hot water jug is emptied into a teapot. After treatment in the Bessemer furnace for an hour and a half, the liquid or matte, which now contains 50 per cent. of copper and 50 per cent. of nickel, is run into the pots again, taken by the crane to another place, and run into large thin moulds, and after cooling, is broken up and sent to Deloro and New Jersey for further treatment, a small percentage of gold and platinum being got from the residue after the copper and nickel have been separated out. The total output of Bessemer or refined matte is about 1800 tons per month. The description of other processes more or less subsidiary would be tedious, but enough has been stated to show the huge scale on which this industry is carried on here and elsewhere in Canada. The machinery required in blowing the furnaces and carrying out all mechanical arrangements of these extensive works is electrically driven, a waterfall about thirty miles distant providing the necessary power.

NATURAL GAS AT MEDICINE HAT: "THE TOWN THAT WAS BORN LUCKY."

Medicine Hat is situated in the great wheat-growing Province of Alberta, and is rapidly rising into importance as a central station in connection with the farming industry. But it is not in that relation that the town has acquired the fame of having been born lucky. It has a well of natural gas in its midst which supplies power, light, and heat at a price unattained anywhere else. The gas issues from a borehole $1\frac{1}{2}$ inches in diameter, under a pressure of 556 lbs. to the square inch, with a capacity of $1\frac{1}{2}$ million cubic feet per 24 hours, and although it has been giving off all that the town has required for years, there is no diminution in the pressure or decrease in the flow. The enormous pressure of its issue is reduced for practical working purposes to 5 lbs. per square inch, for steam raising, and general heating purposes, to 8 ozs. for lighting, and to 4 or 5 ozs. for gas engines. It is sold to manufacturers at 5 cents and for domestic purposes at $13\frac{1}{2}$ cents per 1000 cubic feet. It is said that the saving to the town in the use of this natural gas as compared with coal is at present £12,000 per annum.

This state of matters seems to point to Medicine Hat as offering a particularly favourable sphere for manufacturing industries, especially those associated with farming.

What the limit of the supply of gas may be it is impossible at present to tell. The Canadian Pacific Railway Co. have recently put down a bore at Dunmore, about four miles from Medicine Hat, and have tapped the gas under similar conditions to that at Medicine Hat. The bore hole, 10 inches in diameter and 1060 feet deep, emits the gas at a pressure of 560lbs. to the square inch. When in full flow from a 4-inch pipe at the surface, the gas escapes with a scream so terrible that the ears have to be stuffed to save them from damage. Near the town of Calgary, in the same Province, a bore hole is being put down to a depth of 2500 feet, and already at 800 feet deep has tapped some gas.

It may be that oil will yet be discovered in the same region, but this is in the future. Meanwhile, the inhabitants of Medicine Hat are basking in the sunshine of their good fortune, and regarding themselves with some complacency, because Kipling, taking up a remark by one of the oldest settlers in the place, has told the world that Medicine Hat is "the town that was born lucky."

IRON MANUFACTURE.

Considering the great extent and growing needs of the Dominion, the mining of iron ore and manufacture of iron in Canada do not seem to be keeping pace with the progress of the country. Reference has already been made to the iron works of the Dominion Iron and Steel Coy., and the Nova Scotia Steel and Coal Coy. at Sydney, Nova Scotia. These, with the Acadia Works at Londonderry, Colchester County, Nova Scotia, and Radnor in Quebec, are favourably situated for supplying the eastern regions of the Dominion. There are large and well-equipped iron works in Ontario, notably those of the Hamilton Steel and Iron Coy. at Hamilton, on Lake Ontario; the Algoma Steel Coy. at Saulte Ste Marie, on the river between Lakes Superior and Huron; and the Atikokan Iron Coy. at Port Arthur, on the west shore of Lake Superior. The last mentioned is the only one of these works that uses Canadian ore exclusively, and the proportion of foreign ore used by the others is increasing every year. In 1901, 56 per cent. of Ontario ore was used in the blast furnaces of that Province. In 1907, the proportion had fallen to 23·6 per cent.

The immense deposits of high grade iron ore on the American side of Lake Superior, the moderate cost of working it, and the ease of transport across the lakes into Ontario and eastwards, have probably been the cause of delay in the opening up on an adequate scale of its own resources of iron by the Province of Ontario. On the basis of last year's consumption, the known deposits of the Lake Superior iron ore will last for 50 years; but consumption has advanced with rapid strides from nearly 14 million tons in 1898 to nearly 42 million tons in 1907. If this rate of increase be continued that available supply will be exhausted all the sooner.

Quite recently large deposits of magnetic iron ore have been opened up at Moose Mountain, about 25 miles north of Sudbury in Ontario. The ore body at present operated on has been proved in a length of 1500 feet and breadth in some places of 150 feet, and to a depth of 400 feet, in a vein lying perpendicular. It is stated that twelve similar ore bodies have been proved in an area of 1400 acres acquired by the operating company. The guaranteed analysis on ore sales is:— Iron, 55·50 per cent.; phosphorus, 0·10 per cent.; silica, 13·29 per cent.; sulphur, 0·014 per cent. A railway of 84 miles in length has been built to Key Harbour on Georgian Bay, Lake Huron, where docks are under construction, with the plant of the newest and best kind for the cheap and ready loading of the ore into steamers. A contract has been made with the Railway Company for the conveyance, at a cheap rate, of 500,000 tons a year for 25 years. It is claimed that the harbour is 500 miles nearer the iron-receiving ports of the United States than the mines of Lake Superior, and that this ore will be able to compete with the Lake Superior ore in these markets, as well as supply the demands of Ontario. It seems, therefore, that at no distant date Ontario will be less dependent than at present on outside supplies, and it may be that under the fostering care of the Dominion Government, by whom a bounty is given for each ton of iron manufactured in Canada from native ore, additional works will soon be erected in that district of the country for the supply of its own needs.

The Western Provinces of the Dominion at present seek their supplies of iron from Scotland, but as there are deposits of iron ore in British Columbia awaiting development, and abundance of suitable fuel for smelting, there is little doubt that British Columbia, at least, will ere long be less dependent than at present on outside supplies.

COLLIERIES IN ALBERTA

There is an immense area of coalfield in the Province of Alberta, but little explored or developed up till now. Towards the southeast corner of the province, at Medicine Hat, the coal, so far as proved, is of the nature of lignite. Westwards, towards the Rocky Mountains, it gradually changes in character, till, at Lethbridge, about 100 miles westwards, it is bituminous; while about 70 miles further west, at Frank and Coleman among the mountains, on the border of British Columbia, the coal is suitable for coking as well as for general industrial and household purposes. At Bankhead, near Banff, about 120 miles northwest from Coleman, the coal is more anthracitic in its nature. Approaching the Rocky Mountains at Coleman and Bankhead, the strata have been tilted up, so that the seams lie at a high angle of inclination. This necessarily makes the working of the coal a more difficult problem than in the coalfield of Sydney, Nova Scotia, already described, where the seams are at a moderate inclination and under a comparatively uniform thickness of strata. At Coleman, where presently two seams of 11 feet and 6½ feet thick respectively are being worked, the inclination is 35°. The main level in the thick seam entering from the mountain side is 3000 yards in length, timbered all the way with timber sets of 9 inches to 12 inches diameter, set from 2 to 3 feet apart, indicative of the immense strain to which the underground ways are subjected from the weight and thrust of the mountain strata. The coal is conveyed along the levels in large tubs, in long trains of perhaps 50 tubs, by means of compressed-air locomotives. At Bankhead, near Banff, on the main line of the Canadian Pacific Railway, crossing the Rockies into British Columbia, a crosscut mine driven 5600 feet into the mountain has proved six seams of from 6 to 9 feet in thickness, lying at an inclination of 37° to 45°, with a stretch of five miles along the level course of the seams, and possibly other three miles capable of being worked from that mine. A special feature of the Bankhead mine is the plant for making briquettes. The coal is soft, and a large proportion is small. After the product of the mine is divided into six different grades of size for the market, about 30 per cent. is left, too small to be sold. This is ground to dust, and passed over furnace flues, where it is thoroughly dried. It is then mixed by means of mechanical mixers with 11 per cent. of its weight of pitch, melted, and raised to a temperature of 300°, and passed into the dust in the form of fine spray by a steam jet. The mixture is then carried by belting to a pair of rollers with hollows on their surface, between which, under a pressure of 2,200 lbs. per square inch, the impregnated dust is formed into little square knob-sided briquettes, which are then passed on to a series of slow moving belts, where they are thoroughly dried. Having passed through this series of belts, they come to a point where a self-acting arrangement tips them into another conveyer, which carries them to bins ready to be loaded for the market. These little briquettes are particularly convenient and cleanly for use in household stoves, and the ready market found for this product provides a profitable outlet for the otherwise unmarketable small,

THE COALFIELDS OF BRITISH COLUMBIA

The C[illegible]w's Nest Pass is the southernmost of the two ways through the Rocky M[illegible]ntains by which the Canadian Pacific Railway crosses from the prairi[illegible] of Alberta into British Columbia. This district has come into promi[illegible]nce in late years through the development of its coalfield. This coalf[illegible]d, which is an extension into the mountains of the Alberta coalfield, oc[illegible]rs within the Lower Cretaceous series of strata, which series in Scotland [illegible]ntains no coal, except probably the seam worked at Brora in Sutherlandshire. Remarkably enough, the Carboniferous system, wh[illegible]ch in Lanarkshire is so rich in coal, is represented in that part of Canada by a [illegible]ew thin beds of no economic value. The Crow's Nest [illegible]strict c[illegible]tains many seams of coal ranging in thickness up to 30 feet [illegible]nd [illegible]ting in the aggregate in places to 150 feet. When it [illegible]ated that [illegible] of the government geologists has estimated the amount [illegible]al under [illegible]ch square mile to be 50 million tons, and that one [illegible]any, the C[illegible] Nest Pass Coal Coy., ha[illegible] acquired 100 square miles [illegible]altned, some [illegible] may be formed of the vast stores of coal available [illegible]orkin[illegible] [illegible]e to come. Already this company have worked [illegible] [illegible]s, a[illegible] re presently putting out 2000 tons a day from three [illegible] [illegible] and 10 feet thick respectively, lying at a moderate [illegible]ation [illegible] [illegible] being used for locomotive and general purposes, [illegible] the s[illegible] [illegible] to coke for use at the copper and other smelte[illegible] [illegible] Br[illegible]sh [illegible] [illegible] are other coal properties in the neighbourhood [illegible] C[illegible]w's N[illegible] [illegible] from which large outputs will soon be got, notabl[illegible] [illegible] Hosmer [illegible], where 5 seams of an aggregate thickness of 45 [illegible] [illegible] [illegible]ying at the high angle of 65 degrees, and wh[illegible] [illegible] [illegible] [illegible]cted for an output of 2000 tons a day.

[illegible] it may be interesting to note the rate of wages paid [illegible] workmen in the collieries of these districts, as agreed [illegible] [illegible] mineowners and the Western Coal Operators' [illegible] [illegible]ada, for the two years ending 31st March, 1909. The [illegible] [illegible] dollars and cents: Fireboss, 3.50; shot lighters, [illegible] [illegible]n, 3.00; timbermen, 3.00; drivers, 2.75; track-layers, [illegible] [illegible]00; rock miners, 3.50; main and tail rope riders, 3.00, [illegible] [illegible] [illegible]outers, 2.50; switch boys from 1.25 to 1.50; door [illegible]

[illegible] [illegible]ed and fifty miles further west, and within about 100 miles [illegible] Vancouver, coal is being opened up at Nicola Valley and [illegible] [illegible] will be of great service to the western region of the [illegible]rov[illegible] [illegible] important and long-established coalfield of British C[illegible] [illegible] that of Nanaimo, on the Island of Vancouver. There are two se[illegible] [illegible] coal [illegible] of 7 feet and 3½ feet in thickness. While the conditi[illegible]s in respect of number and thickness of seams at this place are less favourable than [illegible]where in British Columbia, the seams lie at a very moderate inclination, and the colliery has good facilities for shipping and markets.

GOLD, SILVER, COPPER, AND LEAD IN BRITISH COLUMBIA

Nature has been lavish in her gifts to British Columbia. The mountain sides are clothed to the snow line in trees, many of them of amazing height and girth, but gradually disappearing under the inroads of the lumberman. The inland lakes and streams serve as waterways, but are also teeming with fish, the delight of the sportsman, while the hardier hunt man seeks for bear and caribou among the hills. The rushing river is alive with salmon, but in places it also yields sands of gold. The fertile valleys bask in the summer sun, and autumn loads the orchard trees to breaking with the finest fruits. And high above all, the majestic snow topped, glacier flanked mountains pierce heaven's blue. Not always thus, for there are many stony valleys, and bare mountain sides, and naked, rocky tracts, but their very nakedness is a boon to the prospector, enabling him to examine their surface, and, digging under their apparently unpromising exterior, to bring to light veins and masses of ore, yielding to the treatment of the modern smelter results in precious metals undreamt of by the alchemists of old.

The discovery and development of ore bodies have been chiefly in the neighbourhood of the railways and waterways already opened up in the south-eastern district of British Columbia. Only a few of the mines will be referred to, but they will give an indication of the mineral wealth of that region.

The silver-lead mines of St. Eugene in the East Kootenay district, belonging to the Consolidated Mining and Smelting Company of Canada, were begun in 1900. There are openings up the mountain side as high as 1150 feet above the level of Kootenay Lake, and shafts sunk 750 feet under that level. Two parallel veins about 200 feet apart, with branches between, sometimes widening out into masses 40 feet wide, are being mined at the rate of 500 tons a day of ore suitable for the concentrator. Put through the concentrator, and there treated by crushing, washing, and separation, each six tons yield one ton of rich residue, which, sent to the smelting works of the Company and passed through the necessary processes, produces 60 per cent. of lead and 25 ounces of silver.

In copper ore, yielding also gold and silver, there have been large developments in this region at Rossland, Greenwood, and Granby. The Le Roi mines of Rossland have been worked to a depth of 1650 feet in ore lying in more or less irregular veins or pockets averaging 50 feet wide. The yield of this mine during the 11 years of its existence has been on an average, per ton of ore, nearly half an ounce of gold, three quarters of an ounce of silver, and 28lbs. of copper, of which the total value is £3 stg.

The Mother Lode mine at Greenwood, belonging to the British Columbia Copper Company, produces 1500 tons of ore per day from an ore body 150 to 250 feet wide, and opened up at present to a depth of 400 feet. The smelter belonging to this Company treated ore last year at the rate of 2000 tons a day, producing during the year 15 million pounds weight of copper.

But it is at Granby mines, belonging to Granby Consolidated Mining Smelting and Power Company, that the working of this ore is being carried out on the largest scale. The ore is of a lower grade than that at some of the other mines in the district; but this has had the effect of drawing out the inventive skill of those in the management, with the result that the operations of this Company in the working, conveying, and smelting of the ore display an amount of ingenious adaptation of means to ends worthy of admiration. The machinery is of the finest, and on a large scale. Two motors of 700 h.p. each, deriving their power from a waterfall miles away, are connected to two compressors making compressed air at 100lbs. pressure, to be conveyed by 20 miles of pipes to operate 60 power drills in the mines. The great engines and motors, with rope drive, are a fine sight. The mines have proved an ore body of 900 feet in depth, 150 feet in width, and 1000 feet in length. From 3000 to 4000 tons of ore per day is mined. It is conveyed in the mine trucks of 6 tons capacity direct to the crusher, where, after passing through a Bacon crusher, it is conveyed by means of an endless indiarubber belt, 12 inches wide and 244 feet long between centres, to the bin, where it is loaded into trucks to be taken to the smelter. It is impossible to follow the ore through all the stages of smelting, suffice it to say that each ton of ore, after the process is completed, has resolved itself into copper worth 12s. 7d.; silver, 11d.; and gold, 6s. 6d.—in all, £1 stg.

The smelter of the Canadian Consolidated Company at Trail, in the same district, treated 305,956 tons of ore from the mines during last year, yielding 121,388 oz. of gold; 2,221,388 oz. of silver; 32,157,139 lbs. of lead; and 1,004,168 lbs. of copper, of the total value of over a million pounds stg.

During the ten years ending 1907, the production of gold, silver, lead, and copper in the whole of the Dominion of Canada was approximately 58 million pounds stg. Of this amount Yukon produced (all gold) 24 millions; British Columbia, 23 millions; and other parts of the Dominion, 11 millions. It will be seen therefore that the whole territory east of the Rocky Mountains, rich as it has been proved in places to be, has produced less than one fifth of the mineral value west of that range. When it is borne in mind that the mineral products of British Columbia have been confined to an area in the south and south-east not one sixth of the total area of the Province, and that the immense tracts of territory stretching northwards towards Yukon are to a great extent unexplored, but so far as explored are known to contain rich veins of ore, it is clear that there are still great possibilities in the minerals of British Columbia.

CONCLUSION.

In the previous articles an attempt has been made to present to the ordinary reader an idea of some of the more striking features of a number of the mines and works visited by the writer while in Canada. Much that was seen has not been referred to; much more would have claimed fuller observation and description had time permitted and many important minerals extensively mined have not as yet been mentioned at all, because they did not come within the scope of the programme mapped out, large and comprehensive though it was. A passing reference will now be made to some of these other minerals, lest their importance be lost sight of.

The total value of last year's output of minerals metallic and non-metallic in Canada was 17½ million pounds sterling. One tenth of this was gold, Yukon's proportion being three-eighths of the gold production. Nova Scotia, Ontario, Saskatchewan, and British Columbia provided the rest.

Corundum, a mineral which is familiar to us under the name of emery, and fills an important place in our industrial and domestic systems, is mined in Ontario. Craigmount, Renfrew County, in that Province, produces the greater proportion of this useful mineral.

Gypsum, used in the manufacture of plaster of Paris and hard finish plaster, and as a retarder of Portland cement, is worked in Nova Scotia and New Brunswick.

Graphite, which we know as black lead in pencil making and in domestic use, and as a lubricant for machinery, is mined in New Brunswick, Quebec and Ontario.

Ontario produces quartz for the copper smelters, where it is required as a flux in the furnaces, and for lining convertors, which are subjected to high heat.

Antimony, used largely as an alloy with other metals to impart hardness and lustre, occurs in the form of stibnite, associated with gold, at West Gore, Nova Scotia, and is worked there. It is found also in New Brunswick and Quebec.

Apatite, or calcium phosphate, is used in the manufacture of artificial fertilizers. It is found in many localities in Ontario and Quebec.

Mispickel, from which arsenic is got, occurs usually associated with gold. It has been worked for years at Deloro, Ontario, and is found in workable condition in Quebec and Nova Scotia.

Celestite, or sulphate of strontium, a necessary ingredient of fireworks, is of wide distribution. It is found in abundance in Quebec and Ontario.

Feldspar and Fluorspar, employed in pottery work, and by smelters and metallurgists, is abundant in Quebec and Ontario.

Tripolite, or infusorial earth, has many uses. It is an absorbent for nitroglycerine in the manufacture of explosives of the dynamite class. It is also used in the paint industry, and in vulcanized indiarubber, and as a jewellers' abrasive. Nova Scotia and Quebec have deposits of this mineral.

Cassiterite, a tin-bearing mineral, occurs at New Ross, Nova Scotia, and is found in placer deposits as well.

Mica, now used chiefly for electrical insulation, but in past times for glazing, is mined on the borders of Quebec and Ontario.

Platinum, a rare and useful metal to the assayer, being that of which his crucibles are composed, is got by dredging in the Cariboo district of British Columbia, and comprises 30 per cent. of the mineral sperrylite, found at Copper Cliff, Ontario.

Talc, used by rubber, paper, and leather manufacturers, is mined at Madoc, Ontario.

Zinc is an abundant mineral, usually worked as a by-product in connection with lead and silver. There is a zinc mine in Frontenac County, Ontario.

Other less known minerals, occurring at various places in the Dominion, but having limited application in the arts, might be mentioned. Suffice it to refer to one, Rutile, which is used to give the necessary bluish tint to artificial teeth. Quebec and Ontario can provide all of this mineral that is likely to be needed for that purpose.

This excursion among the mines of Canada, from Sydney, Nova Scotia, on the Atlantic, right across the Continent to Victoria on the Pacific, was carried through in perfect weather, and under exceptionally good conditions in respect of comfort and convenience, and kindness shown. It is hoped that the particulars given in these articles have served to encourage a wider interest in one of the spheres of Canada's activities, which hitherto, perhaps, has been too little regarded in this country. While much has already been done in opening up its minerals, a very cursory study of the map of Canada will show that the mineral development of the Dominion is only in its infancy; that there are immense areas still undeveloped for want of means of transport, and immensely greater tracts still unexplored, which may yield rich returns to the prospector. The country is healthy. Its people are enterprising and loyal. The King is everywhere honoured; law is held in respect, and order prevails. The influence of Scotland in the past in opening up and colonizing the country is apparent on every hand; but it is no less widely acknowledged, for from end to end of the Dominion, Scotland and its people are held in high regard.