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Established 1882

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SIGNS OF THE TIMES.

Now that there are signs of a renewed interest in mining, the daily papers are beginning to devote a considerable amount of space to mining affairs. They are making rather bad weather, however, of certain mining terms. For instance, quartz is spelled "quarts" in one enterprising sheet; it is also described as "acciferous." Nuggets of pure gold, as big as office inkstands, are said to have been brought down from regions "away up North." La Tuque is spelled "Laterque." Chibogamoo has now become "Chibugamoo." But after all, the public is very much interested in these reports, and that is the object for which they are written.

A LITTLE KNOWLEDGE.

Ever since the days of '49, each succeeding rush to a new mineral district has been composed principally of amateur prospectors, men whom, while they were full of enthusiasm, knew next to nothing of mining or minerals. The Klondike had more than its share of these gentlemen. Although they were equipped with high boots, picks, shovels, drills and geologists hammers, they were usually utterly incapable of sinking to bed rock through three feet of gravel. Just at the present moment Cobalt is full of men of the same type, and their chance of finding anything of value is certainly not as good as was that of their predecessors in the far Northwest, because it takes considerably more knowledge of formations and minerals to seek intelligently in Ontario and Quebec than it did to discover placer gold in the Klondike.

But the optimism of some of these amateurs is a beautiful thing. The geologist goes to his task with a thorough realization of its difficulty; they can see no trouble ahead, but depend upon inspiration for the discovery of mines that will sell for at least a million dollars a pace. Happily, our Northern hinterland is peculiarly favourable to health and longevity, so that it is not probable that a season's roaming will hurt these young fellows, on the contrary, it will do much to increase their vitality, and fit them for a long, useful career of office work when they return. But we will venture to predict that the only men who will achieve much in the North will be those who are accustomed to life in the open, are imbued with more than average physical strength, and are expert not only with the pick, but with the paddle.

PERSPECTIVE IN MINING.

By J. Parke Channing.

(Address delivered before the Engineering Society of Columbia University).

The melancholy Jacques in "As You Like It" says, "Call me not fool till Heaven hath sent me fortune." Call me not fool till Fortune hath sent me the opening up and equipment of a mine; for in mining there is so much that is not teachable, nevertheless learnable, that unless a man has this instinct, inherent in all capable persons, he can never hope to achieve success as an engineer. Each mine is, so to speak, a law unto itself, and not until the engineer recognizes this can he get true perspective in mining.

When you leave school and start out in practical life there are certain things that you have heard in your studies which have impressed themselves upon you. The reason for that impression would be hard for you to say. It may be that some particular thing had interested you because of some previous experience of yours. As a result you are really not able to define the proper relations between things, and that is one of the reasons why a man, after he graduates, should not start immediately on consulting work, or to take entire charge of any enterprise.

It should be remembered that your course in the school is simply one of preparation; in other words, if you want to learn the mining business you have got to go into the mines and study it, just as if you were going to learn the dry-goods business you would have to go to a dry-goods store; to learn banking you would begin as a messenger or clerk and work your way up. The only advantage of going to a school of mines is that you get a technical education; you have a certain ground-work, which helps you out, and you also have gained a very important thing in knowing how to study, and knowing how to put two and two together so as to make four, and not three or five.

When a man goes out I would advise him to get a position at some mine or metallurgical works; it is not always desirable that it should be a particularly large mine or works; often he gets a better knowledge of what is going on by working in a smaller mine. When you take your first position in a mine I would advise you to work underground. This gives you an opportunity of watching mining work—sinking, drifting, stoping, timbering, tramming,—and it particularly gives you your first idea of the proper relation of things.

About fifteen years ago I was running the East New York mine at Ishpeming, Mich., and Mr. T. F. Cole, who is now manager of all the iron mines of the United States Steel Corporation, was running the Queen group of mines at Negaunee, Mich. We used to compare cost sheets, and his cost of development amounted to 2 5 cents per ton and mine amounted to 25 cents per ton. The reason for this was that his ore-body was in area ten times as large as mine, and, although my shafts and crosscuts were of the same length as his, the decreased tonnage was against me. This simply shows how the cost of development has got to be watched in its reference to the size of the ore deposit.

Take for example the opening of an iron mine at Lake Superior; after first striking the ore, the proper thing to do is to sink a small one-compartment shaft, one big enough for a good size bucket and ladder. With a shaft of this size you can get down to the ore and you can get out a good deal of ore. After you have gone down a hundred feet and have your drift, and have some idea of the size and shape of the ore-body, you can, if you find the conditions warrant it, put in a larger shaft.

I have seen prospecting or development schemes wrecked by the man in charge spending a lot of money and time in sinking what he called a "working shaft," and when he got down found that there was nothing to work, or at least it could have been worked through a small shaft. In prospecting or small mine work you don't want to put in any brick set or water-tube boilers, and you don't want too large an engine. You want to get a cheap portable locomotive or upright boiler. It won't hurt to burn a few extra cords of wood.

On the other hand, you also want to try to get the idea of how far you should go on equipment without going to the point of over-equipment. Suppose, for example, that you finally take hold of a mine that is developed and is producing ore for shipment, and you find the mine is fairly well equipped when you get there. You may find a great many things that do not satisfy you or do not come up to your ideas. You may find a shaft-house that was badly arranged; you may find that the hoisting engine is one that uses too much steam, and the compressor is not the right thing; that the shaft is crooked, and there is no skip, only a bucket. Now, don't be in too much of a hurry to tear all of these out; go ahead and see what you can do with them, until you get to the point that you can definitely see and figure it out in dollars and cents, just how much you will save if you were to sink a new shaft or straighten out the old one; or if you were to build a new engine house or put in a new engine.

Some of the men who were at Copperhill, Tenn., last summer remember the excellent plant we had at the Burra Burra mine; there was a brick house containing water-tube boilers; there was a big power-house which contained a first-motion hoisting engine, together with a cross-compound, two-stage, air compressor, with room to put in another one. There was also a shaft crusher-house with its paraphernalia. When I equipped that mine I had at the same time the idea of later putting in a similar equipment at the London mine, and I had the plans drawn and everything arranged for it. But, after carefully thinking the matter over and seeing the tonnage that came from the latter mine, I finally came to the conclusion that I would make a great mistake to take this mine, which was only 500 ft. long and 30 ft. wide, as compared with the Burra Burra, which was 1,600 ft. long and 80 ft. wide, and give it the same equipment, notwithstanding the fact that it would be very nice to have two or three mines all provided with exactly the same type of equipment. So, instead of putting in a duplicate of the plant we had at the Burra Burra, I simply bought a cheap geared hoist and put it back of the London shaft in a small building covered with corrugated iron, and we used the same boilers that had been used there since the beginning of the development work.

The more you work the more you will find out that there is absolutely nothing that cuts down cost as much as tonnage. Another suggestion is this: When you start up a new mine don't be in too much of a hurry to build a nice house for the manager or superintendent, or too grand an office building. That is one of the things that an English engineer at a new mine looks after before anything else. The first thing he does is to build himself a house, and then he goes ahead and develops the mine. If your mine happens to turn out all right it is very good to have lived well while developing it; but if it does not turn out all right, then the house that you built will be a monument to your folly. While I don't advise you to open up a mine

and live in a hut or tent all winter, you must use proper judgment as to the kind of a house you do build.

Take, for example, the cost of underground haulage; you know that the tendency now a days is to do underground haulage, wherever possible, with electric locomotives. It figures out as very economical, and the electrical people will be only too glad to estimate on the cost of installation and operation, but you must remember that it is the opinion of most mining men that for medium distances, say 500 or 600 ft., you can do nothing better than to use man power, for the reason that you have to give the man loading the cars a rest and he gets this rest, if the grades are properly made, by pushing his car out and waiting a minute or two at the shaft until it is dumped, and then pushing the car back again. This is a change from loading the ore, and so he trams really for nothing.

At one of the mines in Bingham Canyon, Utah, they mine about 1,000 tons per day, and it comes out from one adit, where it is handled by four horses—two on each shift. At one of the adjoining mines they put in an electric tramming plant, and yet the tonnage they have could readily be handled by two horses. It does not take much figuring to see that two horses are cheaper in first cost and up-keep than an electric installation. So, therefore, in adopting any particular apparatus, or any particular method, you must take into consideration the tonnage and conditions under which it is operated.

When you come to metallurgical work this factor will be strongly emphasized. Remember that you do not want to get things too automatic. I remember when I was talking with the late Richard P. Rothwell, of *The Engineering & Mining Journal*, about Mr. Edison's iron-ore plant out in New Jersey; he said that the plant was too automatic, and that once in a while there should have been an Italian with a shovel. You will notice that at some concentrating mills they may have a certain product that has to be handled or moved to some other part of the plant for re-tretment. In a small mill that amount is so slight that one man could shovel it as it accumulates, so that under these circumstances it is no use putting in an elevator or some other apparatus to handle this small amount of material. In a large mill, however, it may be really necessary to have something to carry your concentrate and middling from various points where they are produced to a central point.

In metallurgical work, modern practice is along the line of labor-saving devices, but in a small blast-furnace plant, where you have but one furnace, it is a question whether it would pay you to put in a so-called automatic charging apparatus. This is the method in use at large plants, where the ore is run into cars and pulled by an electric locomotive to the furnaces. I believe that there is no doubt that one could get better metallurgical results in copper-blast furnaces by hand-charging than by dumping the charge from cars, but the cost would over-balance the metallurgical saving.

In places like Mexico, where wages are only 75 cents to one dollar per day, it is sometimes impossible to get enough men to do the work, which, of course, necessitates your putting in labor-saving devices, not to save money, but to run at all. When we started in Tennessee labor was a dollar per day, and we seriously considered whether it would be advisable to put in a charging apparatus for the furnaces. But I felt that in the South it would be difficult at times to get labor, and so, fortunately, I put in electric charging cars, and they have been a great success. This question of shortage of labor is important in an agricultural country. Take for example in Mexico: In the spring-time the men go off to plant their corn, and when it comes autumn they go off to harvest it. You notice the same thing in Tennessee. In the spring the men go to plant their crops, and when the time comes to harvest, off they go; they do this regardless of whether it would pay them better to attend to their farms or not. For instance, in Central Mexico, where laborers receive two or three dollars a day, a man will leave his position and go to harvest a $30 crop and lose $60 in wages.

A man can frequently be penny wise and pound foolish in refusing to advance the wages of good men. So do not always be looking at your pay-roll with the idea that the best way to economize is to cut down wages. The first thing that an untrained man does when he goes to a mine is to try to find some way to save money. He looks at the pay-roll and finds that it amounts to $10,000 per month and that the supplies are $5,000, and that the mine is running behind. He concludes that the only way to remedy the matter is to cut wages. He does this; his men loaf, or the best leave him, and he runs still worse behind.

You want to be careful to see what work per man per day you get, so therefore it is essential to remember when you are engaging labor to pay about the same wages that are being paid by others in the district, and be slow about reducing wages, but see that the men work. Try rather to keep your wages a little bit higher than anybody else, so that you can get the best men; let the other fellows keep the poor men. If you get a good man and pay him 25 cents more per day, he will probably do a great deal more work.

Perhaps the young men who were down in Tennessee remember the two big trammers we had at the Burra Burra mine. One of the men has been with us at least four years. He is a stout, husky fellow, and would load just as many cars as two ordinary men would do. The ordinary man would load ore at 18 cents per car and perhaps get out 20 cars per day, while this one man would get out 16 or 18 cars himself. Now, then, think of the money we would save if all our men were of that kind. It would mean that, if we wished to, we could practically double the output of our mines.

Another thing you want to bear in mind is this: Never be afraid to engage a man who knows more than you do; that is just the kind of a man you are looking for and just the one you want. A young man, as a rule, never wants to engage a man, or have any man under him, who knows more than he does. If you engage a foreman, get one that knows all about the handling of men. If you get an engineer, get an engineer, that knows something that you do not know, one who has had lots of experience at other mines; his experience will be of great benefit to you in solving new problems that will arise.

While I have referred more to the economical details of operating, there is another perspective view which takes a long time to get, and that is a comparative idea as to value of mines—whether there is really a mine or not—or whether it is going to be a small mine or a large mine; and the only way you get that is by looking at as many different mines as you possibly can. Never loose a chance when you are travelling or looking for a job to go into a mine and through its workings. If you visit a mine of any importance, try to get a position in the underground workings, because that is one of the things they cannot teach a man and which can only be acquired by long experience and by looking at different properties.

I might say that your college experience has enabled you to make a quick decision. Really the main thing in mining is the capacity to see a property in a partially developed stage and from that inspection be able to

determine whether it is going to be a mine. You find that it has 50,000 or 60,000 tons of ore in sight, and that it seems to have the earmarks of a large deposit, and you will advise your people to take it. If you have the courage of your convictions, if you think that it is good, stick to it and do not let the property go by. It is a great deal better for a man to make a mistake once in a while in getting hold of a property that does not turn out well than it is to let a good one go by. Still, however, if a young man makes two or three of these mistakes, it is likely to go against him in the long run; so I say to you, that when you start out, keep away from making these examinations, or, at least, from consulting work. It is very nice for you to go in as assistant to some engineer and help him in sampling and making determinations as to the value of mines, but do not get yourself into a position where you are called upon to pass judgment upon mines, because you may get yourself into some bad predicament, which will take a long time to live down.

I do not want you to understand that I would recommend a man starting out to begin as an assistant for an examining engineer. It is pleasant work, but I think that if one starts out in it he is liable to get rather a bad habit. Remember that the really successful consulting engineer is that man who has the capacity to size up a mine and to determine its value, and who thoroughly understands the cost of operating it. The whole tendency to-day is toward the mining of low-grade ore bodies, and the question of operating expense is one of vastly more importance than the question of sampling and assaying the ore. For example, take the large porphyry ore body in Bingham Canyon, Utah; a man who examined it stated that it averaged less than 2%, yet his samples checked those of the mine manager within 0.01 per cent.

I recently examined a concentrating property in Nevada and the ore ran slightly under 3%, my samples checked on one of the mines within 0.03% and on the other mine within 0.02% of the results of the management. So you see that sampling, to a certain extent, is mechanical. In a large concentrating proposition of this kind the main thing is, what is it going to cost to mine and treat the ore. The original report on this mine by the manager had been taken over to Paris by the senior member of a large banking house and the figures as to the grade of the ore and the cost of treatment submitted to several French engineers, who simply laughed at the thing, and said it was impossible to treat ore of that grade. My examination showed that the conditions were exactly right for a big property—one that could be handled and show a large profit. The trouble with the French engineers was that they had not kept up with the latest practice in concentrating or the latest methods in reverberatory smelting, and, while they were only two or three years behind, they might just as well have been twenty years behind the times. Therefore, I say to you that one of the most important things for a successful consulting engineer to have is a good knowledge of operating; the only way to get a true idea of operating is to work your way up from the bottom.

There is also one other important thing in mine examination and mine operation, and that you have to study and pay particular attention to, and that is the geology. If it is copper, you must keep yourself posted thoroughly on secondary enrichment; if you do not, you will have difficulty in getting along. It was about eight years ago that I examined the Highland Boy mine in Utah; the fourth and fifth levels were then opened up and showed an average of about 7.3% copper and considerable gold and silver, but I could see plainly that a good deal of that copper was in the form of chalcocite, which I knew was secondary. Another engineer, who came out about the same time, looked the property over, and, although he agreed with my sampling and assaying, he predicted that the sixth level would only go one per cent.; he gave too great a weight to secondary enrichment; later developments showed that the lower levels went four per cent. and the result was that his people lost a fine property. This simply shows the necessity for keeping thoroughly up on the literature of ore deposits, because it is being added to day after day with great rapidity. Of course, this is not as absolutely essential to you as a knowledge of operating, because there are certain geologists who make a specialty of studying ore deposits. In case of necessity, you can get a man of this kind to help you out, and you perhaps may be able to make certain economic conclusions which he was not able to see. Some of the big mining companies keep an economic geologist at work all the time. In a small mining company that is impossible, and the geologic work devolves upon the mining engineer.

When you get a mining engineer you want to get a man that has been well schooled, one who understands geological conditions and is able to lay out future work. This has been done in the Butte mines in the last three or four years, and I believed there is not a single crosscut in the mines of the Amalgamated that is not laid out on paper in the office before a stroke of work is done underground. Of course, you get a much better training now in geology than I ever got, not because your professors are any better, but simply because the subject is more thoroughly understood than it was twenty years ago.

Therefore, I say to you study economic geology just as much as possible, because the question of ore deposition is one of such vital importance that you must forever have it before you. Whenever you see an ore body, and it is a particularly rich one, you want to look at it carefully and study the conditions and try to determine whether these conditions exist a hundred or a thousand feet down, or whether they are only local conditions. This capacity to see is one of the things that you can only learn by going around and seeing, and remembering what you see.

SOME LABORATORY EXPERIMENTS WITH ELECTRIC FURNACE.

By J. W. Evans.

The following experiments were begun in April, 1904, but, as the writer had only his spare moments to devote to the work, it was not until September, 1905, that satisfactory results were obtained.

In the first experiment a fire clay furnace was used with electric energy supplied by a small Brush direct current generator of 20 amperes at 35 volts, driven by a 2½ H.P. gasoline engine.

The results were not satisfactory, the voltage being too low to keep the arc alight, and it continually went out causing annoying delays, also the amount of ore treated at a charge was very small, and, although some small steel buttons were obtained, it was decided to work on a somewhat larger scale. Not being able to purchase a larger generator, the writer built the alternating current generator and exciter shown in

PLATE I.

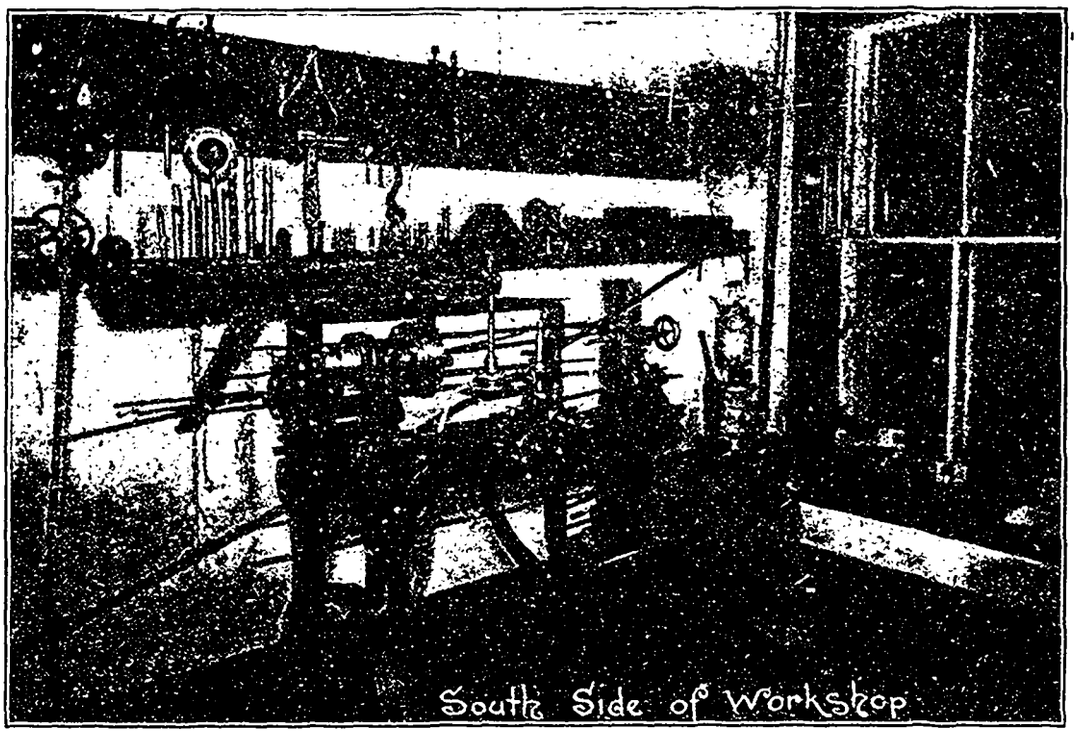


PLATE II.

PLATE III.

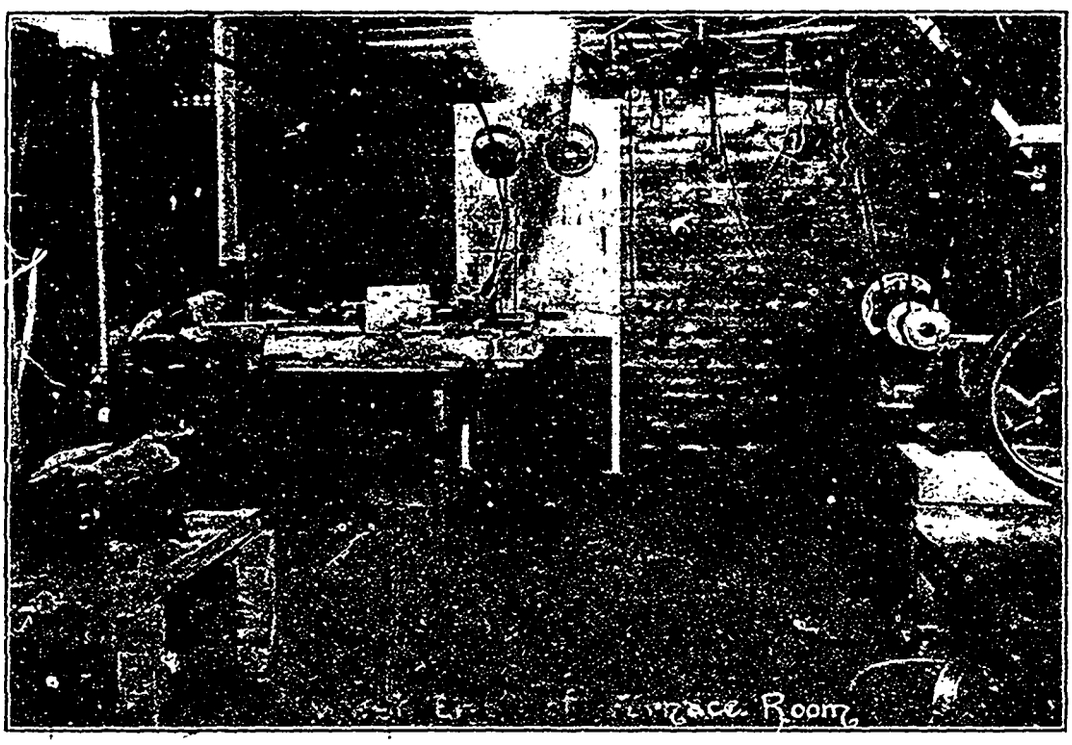


PLATE IV.

photograph No. 3, during the winter of 1904-5. Plates No. 1 and 2 show the workshop. This occupied his spare time that winter, and it was not until June, 1905 that smelting operations were begun again. The generator was built to furnish 30 amperes at 50 volts, and gives from 40 to 50 amperes at 50 volts for short runs without undue heating, and is driven by a 4 H.P. gasoline engine, furnishing energy for the three furnaces shown in Diagrams No. 1, 2 and 3.

DESCRIPTION OF FURNACES.

Diagram No. 1, is a furnace of the reflected arc type as devised by Moissan.

In Diagram No. 2, the electrodes are placed in a vertical position, the lower electrode passing through the furnace to the carbon crucible, which rests upon carbon packed round the electrode. The lining of the furnace consists of corundum mixed with 8% of tar and is baked for 48 hours in a hot oven before use.

The carbon crucibles are made of ground carbon and tar stamped out in a large sized cupel mould and baked in the same manner.

The furnace is supported by an iron ring stand such as is used in laboratory work.

Diagram No. 3 shows a furnace arranged for either fire clay, magnesia or carbon crucibles, and has the electrodes suspended above the furnace, they can be raised or lowered at will, and the arc gap can be regulated. The holder for the electrodes is made of hardwood (See Fig. 4, Diagram No. 3), with two ¾" holes bored as shown. A "V" shaped cut between the electrodes, and extending almost through the wood, allows the holder being bent as shown by the dotted line. An adjusting screw regulates the amount of bend, and two handles projecting out behind enable the electrodes to be put in contact to start the arc, when, upon releasing them, they spring apart to the distance set by the adjusting screw. This makes a cheap and efficient holder. The carbons should fit the holes snugly; if loose, a screw at "f" holds them securely. As the iron ore, when fused, has a tendency to draw down the arc, the arc plays round the crucible at the extreme ends of the electrodes, and in both this furnace and in No. 1, the writer has made a mild steel from the ore in 20 to 25 minutes taking an ounce of ore at a charge. By adding more ore from time to time, a continuous furnace can be made of each of the above furnaces until the capacity of the crucible is reached; the large buttons shown were obtained in this manner. When using a carbon crucible a coarse-grained pig iron is first obtained, by leaving this in the furnace too long it takes up considerable carbon and puffs up into an iron carbide. No. 2 Furnace having the current passing through the charge, and requiring a carbon crucible, is not as quiet a running furnace, and the product is not a fine steel but a coarse-grained pig iron; buttons of steel were obtained from this furnace, but it does not work as well as the suspended or reflected arc furnaces. The writer is now using a special design of furnace which completely reduces an ounce of ore in from 15 to 20 minutes, and converts it into a fine steel.

FURNACE LININGS.

For furnace linings the following substances were tried, fire clay, magnesite, carborundum and corundum. Carborundum or corundum mixed with 8% of tar, when thoroughly baked, makes a very satisfactory lining, although it must not come in contact with the iron charge. An inside lining of magnesite overcomes this difficulty. At present the writer is using fire clay crucibles in a furnace lined with corundum and tar, the crucibles being broken after each operation. Pouring the slag and steel was tried, but it was found that such small quantities cooled too quickly for pouring.

REDUCING AGENT.

As Charcoal is the only available domestic reducing agent obtainable in North Hastings and other parts of Eastern Ontario, the experiments were confined to its use as a reducing agent.

ORES HIGH IN SULPHUR AND TITANIUM.

In treating the sulphurous iron ores over 92% of the sulphur was slagged off, and by varying the amount of lime, better results should be obtained. In treating the titanium iron ores, steel was produced which did not contain a trace of titanium, but, as the writer wished to retain a portion of the titanium, the quantity of lime in the charge was reduced and the result showed that the titanium contents in the steel can be readily governed in this way, although the temperature of the furnace will have to be kept as constant as possible.

When one considers that there are immense bodies of titaniferous and sulphurous iron ores in Ontario and Quebec, and that fine water powers are within reach of many of these deposits; that there is abundance of wood for charcoal and quantities of limestone for flux in the immediate vicinity of the ores; that in treating them by this method one does away with all preliminary treatment, such as magnetic separation, roasting, etc., and obtains steel in one single operation. It does appear that the day is not far distant when Ontario and Quebec will be able to do their share in furnishing fine grades of machine, spring and tool steel, not to mention the possible valuable by-products, such as titanium-silicon, etc., obtainable from the titanium slag, etc.

In the writer's opinion it is doubtful if Pig Iron can be made in Canada by the electric furnace cheaply enough to compete with the blast furnace at the present time, but the finer grades of steel undoubtedly can be made profitably when smelted directly from the ores.

IRON SANDS.

This process should also solve the question of treatment of magnetic iron sands, of which there are large deposits in both Ontario and Quebec, and the writer has made a mild steel containing .05% carbon from magnetic sands from the St. Lawrence River. These sands could be dredged and dried, magnetically separated, and conveyed direct to the furnace at a considerable saving in cost over mining and crushing iron ore.

ANALYSES OF ORES AND STEEL.

The following analyses of the ores, and of steel obtained from them may be of interest:

ANALYSES OF ORES FOR IRON, TITANIUM AND SULPHUR.

Coe Hill Ore (*Sulphurous*).		Bowen Mine Ore (*Titaniferous*).	
Iron	68.01%	Iron	45.17%
Sulphur	1.01%	Titanium	7.44%

A.

ANALYSES OF STEEL FROM COE HILL ORE.

No. 1.		No. 2.		No. 3.	
Silicon	.01%	Silicon	a trace	Silicon	.04%
Sulphur	.12%	Sulphur	.17%	Sulphur	.08%
Carbon	.05%	Carbon	.07%	Carbon	.06%

B.

ANALYSES OF STEEL FROM BOWEN MINE ORE.

No. 1.		No. 2.		No. 3.	
Silicon	.62%	Silicon	2.31%	Silicon	.05%
Titanium	.37%	Titanium	1.02%	Titanium	none
Carbon	.51%	Carbon	.84%	Carbon	0.87%

When much lime is used as flux, titanium slags off readily. If titanium is retained in the steel, by lowering the amount of lime a large portion of silicon is retained also

In B. No. 2, the proportion of ore to lime was ten of ore to one of lime. In No. 3, ten of ore to two of lime.

Plates 5 and 6 show the writer's laboratory where most of the determinations were made, but the writer's thanks are due to Mr. A. G. Burrows, of the Provincial Assay Office, Belleville, who made several of the determinations. A number of samples of the ores, steels and slags are shown in the case on view, duly marked with the analyses, and locality, etc.

ANOTHER SMELTER FOR COBALT ORES.

Mr. Emil R. von der Osten, C.E., the future superintendent of the German-Canadian Smelting and Refining Company is now in Toronto. It is proposed to erect works on a site somewhere on the line of the Temiskaming and Northern Railway; the Provincial Government granting a free site. Mr. von der Osten has furnished the CANADIAN MINING REVIEW with the following details of the proposed undertaking:—

The German process may be used in Canada on certain conditions, the most important being that the process is kept secret.

Final arrangements must be approved by the First Director of the Geological Institute & Mining Academy, Berlin, Herr Geheimrath Schmeisser

The experts must be Germans.

The works will be concentrating, roasting, refining and Cobalt-blue Works.

The German National Bank would like to see the works in Germany if this were possible, and might then finance the whole; if they are established in Canada, the bank will assume a part of the financing.

In Germany 52% of the world's production of cobalt oxide is used, and Mr. von der Osten has guarantees for a market of 100,000 lbs. Ore was sent in November, 1905, by the Commissioner General of the Canadian Government at the Liege Exhibition to Germany for treatment, and the results were very satisfactory. The experiments were made by Prof. Pufahl and Dr. Krusch.

The intention of the company is to put up a concentrating plant first, to treat low grade ores, and then the cobalt oxide works; lastly a roasting plant. That means that the company's works will be started with the wet and dry process.

The expenditure in Canada will be about $445,000. The headquarters will be in Toronto, and the name of the company will be changed to The German-Canadian Smelting and Refining Company. The capital will be $1,000,000.

The Allis-Chalmers Co., Chicago, are supplying part of the machinery. The special machinery will come from Germany.

Mr. von der Osten is sailing for Germany in a few days to complete arrangements.

A FEW HINTS TO PROSPECTORS.

By CHARLES A. BRAMBLE.

Prospecting, up to and beyond the Height of Land, is a new pursuit, and men who have grown grey at the game in other regions will find that they have a good deal to learn when they take their fortunes in their hands, and embark on the waterways that are

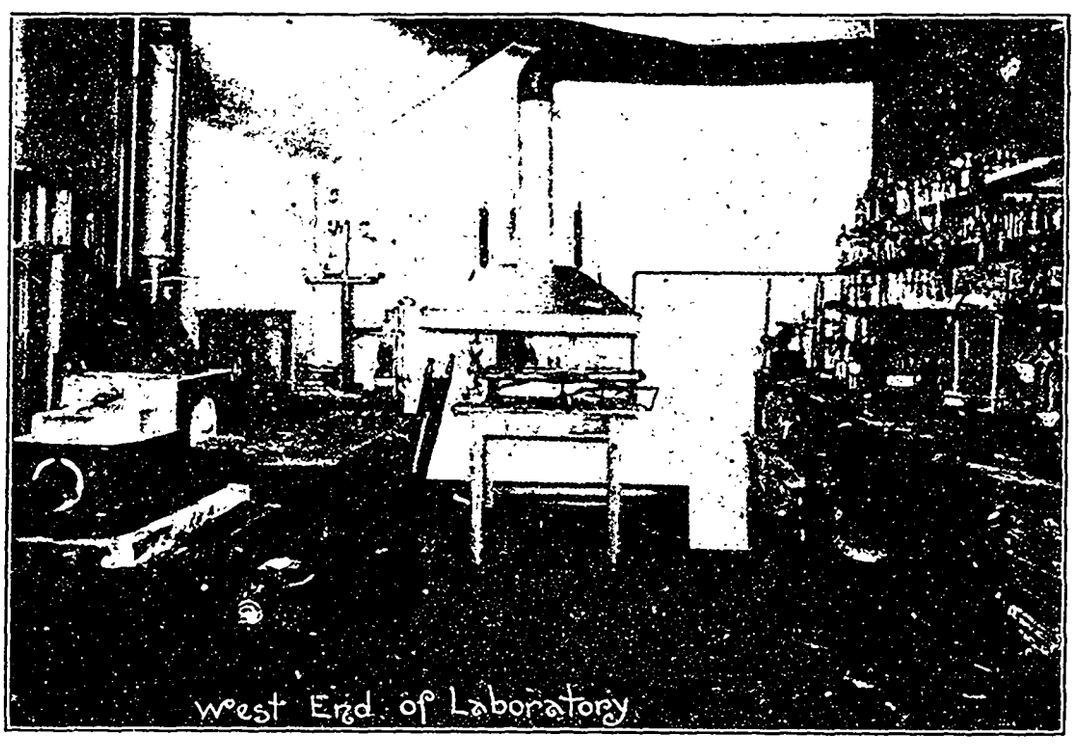


PLATE V.

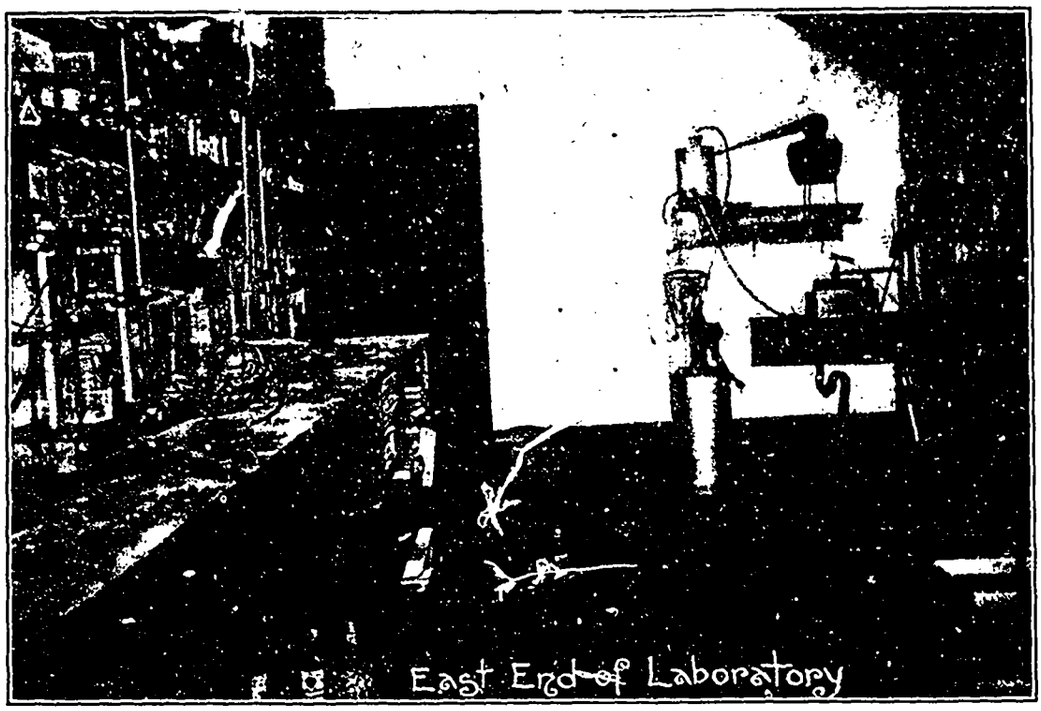


PLATE VI.

tributary to the Ottawa, the Moose, and other streams flowing north and south from the parting. Practically, the only routes by which a man can travel are the rivers. The pack pony and the burro are unknown; there is no grass, so that animals would have to be fed upon imported provender, and, this of course, would render the use of a pack train almost an impossibility in the case of prospectors. Happily, of waterways there is no end, and the canoe will carry a man and his belongings, provided they be few in number, to the uttermost parts of that great lone land that is so soon to resound to the hum of industry and the throb of machinery.

But that's the rub. In order to travel successfully in the North, the prospector should travel light. He must cast away all superfluities, and do without luxuries. He will find tinned food a mistake; strong men in hard work need the sustaining power that is given by good Chicago mess pork and the solid and substantial bean. Cans are heavy, and no one cares to carry useless weight over the long and arduous portages that bestrew the way of the wanderer, so liberally in the homeland of the Algonquin. During the summer a pair of blankets should suffice in the way of bedding; a light tent made of drill will, if properly pitched, keep out even heavy rain, and is therefore to be preferred to duck or canvas, each of which weighs more than the drill; for those who understand the "birchbark" it is to be preferred to the Peterboro, or any other wooden canoe, as it is a better craft in bad water, lighter, and considerably easier to portage in consequence of its depth, the shallow Peterboro, resting upon the head, while the deeper birchbark presses on the shoulders. But a birchbark would be of no possible use in the hands of a man who did not understand its peculiarities, being fragile as a bonnet-box.

Provisions must be simple, nutritious and easily prepared. Everything should be packed in cotton bags, otherwise some very interesting mixtures are likely to result, though it is a question whether they would be appreciated by a hungry prospector trying to prepare a toothsome meal at the end of a hard day's work.

The green hand is almost sure to visit some of the outfitting establishments, and be persuaded to buy fancy sleeping bags, pack baskets, safety axes, and other ridiculous impedimenta. A new flour sack, costing a quarter, makes an admirable dunnage pack. Coarse grey blankets are preferable to a sleeping bag for summer work, and in the winter nothing will equal a rabbit skin blanket, which is only to be had from the Indian. All packages should be made up in a blanket roll and carried by a broad strap, called a tromp line, which may be worn looped over the forehead or the shoulders. Those who are not accustomed to carrying heavy weights almost invariably use the line around their shoulders, but as this interferes with free, deep breathing, and, moreover, renders it almost impossible to throw off the pack in a hurry, it is not a practice to be commended. The only workmanlike way to carry a heavy pack is with the tromp line resting across the forehead, and the weight reposing in the hollow of the back; but it takes some practice to develop the muscles of the back of the neck until they can endure the strain.

Not a few prospectors have been drowned through having packs so rigged that they could not free themselves from them at will. If a man slips when walking a slippery log, or when crossing a wet tree trunk spanning a torrent, he is almost sure to come to unutterable grief if his pack is not so hung that he can free himself without the loss of an instant.

Perhaps the most difficult part of the outfit to arrange for is the prospecting tools. Drills and hammers are too heavy to carry over long portages, unless the party is quite a strong one, so that it is, probably, wiser for the solitary prospector, or for a small party, to be content with their axes and prospecting hammers. The blow-pipe, if the prospector has sufficient knowledge to use it intelligently, is invaluable. A dipping needle should not be omitted, and a thermometer, aneroid, tape line and prismatic compass are useful.

Although the main waterways are, as a rule, laid down on the latest maps with fair accuracy, there are great stretches between the larger rivers that have never been visited by surveyors. These are the most tempting fields for exploration. The possibilities are great, but in order to cover much ground in a short summer, the prospector must be equipped in such fashion as to be able to go from point to point with great rapidity. When matters can be so arranged that he will not have to make more than one trip over each portage, he may cover long distances day after day without effort and fatigue; when, on the other hand, he has to return several times, he will not be able to go far. The Indian generally manages to get along with an outfit that enables him to go straight ahead from morning until night. A solitary Indian trapper uses a birchbark canoe 9 to 11 feet long, weighing not over 25 lbs. His dunnage will not often weigh more than 75 pounds, even when it includes one or two steel traps and his rifle. Owing to his strength and endurance he can easily carry all his belongings, including the canoe, upon the head, so that each portage only occasions a comparatively short delay. Under these conditions thirty miles a day can be accomplished by a good man for several days in succession. On the other hand, parties of white men burdened with a heavy outfit may not average five miles a day on bad rivers.

Although, there is often game and fish to be had, it is not wise to trust too much to the resources of the country. It is wiser to always have a sufficient stock in reserve to carry one to some Hudson Bay post or Indian encampment, where food can be obtained. When fish or game is abundant the prospector should husband other provisions, only drawing upon these when necessity arises. It is a great mistake to think that vegetables and flour, sugar and tea are absolute necessities. Life, and not only life, but health may be preserved upon game or fish for an almost indefinite period, the only condition nature imposes being that the man thus fed take sufficient exercise, and this is rarely lacking when the settlements are left behind, and a man's own arms or legs furnish the motor power.

The special correspondent of the *Mail and Empire* wrote to his paper from Cobalt:—Until the coming into prominence of the Cobalt region, "prospector" was a term little known in Canada, at least in Ontario. Now, however, the name "prospector" is claimed by nearly nine out of ten of the people one meets up here in this North country.

From the picturesque shores of Lake Temagami to the breezy plateau of the Height of Land and beyond the prospector is blazing his trail. Having procured his license, for which he contributes to the Provincial Treasury a fee of $10, he gathers together his outfit which generally consists of the following articles: A light canvas tent, a sheet-iron folding stove, the indispensable pork and beans, with flour, meal, salt tea, coffee, and sugar. Portions of his ordinary attire are discarded for a sweater, long boots, and slouch hat. A canvas sack bound by a tote strap, is used for carrying supplies over his shoulder. A hand axe and six-shooter fastened to his belt, with a shining new prospector's pick in his right hand, complete his outfit. He then immediately proceeds to "hit the trail," and, with the recklessness of "Rasselas, who tired of his happy valley and sighed for the free breezes of the hill tops," he keeps moving along. He invariably selects for his camping place a locality where likely ledges of rock abound, and as convenient as possible to a good supply of water. The light stove he carries is more for the purpose of heating the tent at night, for his cooking is generally done outside on the old-fashioned camp fire. Often he is alone, but generally four or five band together, and one of their number acts as cook. The privations and hardships they undergo are innumerable and indescribable, but they are mostly forgotten in the feverish quest for wealth, for there is ever present before the mind's eye of the prospector the constant anticipation of "striking it rich."

The foregoing extract should be carefully studied by would-be prospectors with a view to avoiding such an outfit as is here mentioned. When the "Yukoner" made his famous rush for the golden North, the one article of equipment that he hugged more closely than any other was his little, foolish sheet iron stove. The hardy old sour doughs had never heard of such a thing. They had always found a good log fire in the open sufficient for their wants when they were travelling and if they were in a permanent camp, they manufactured most ingenious chimneys out of rocks and clay; but the Yukoner could not do without his sheet iron stove, which was simply a burden to him in most cases. It seems that history is repeating itself, and that in Northern Quebec the aforesaid stove is penetrating the places that knew it not.

Again, we are told that the latest variety of prospector is wearing long boots. For canoeing purposes the long boot is about the worst kind of boot a man can put on his foot. If he adds some good sharp nails to this heavy foot gear, he will achieve the wrecking of his canoe all the earlier. Ankle boots or moccasins are far better. Why any man should want a sixshooter in Northern Ontario surpasses our comprehension. It must indeed be a magnificent sight to see one of these brand new prospectors starting off with an axe in one hand, a shining prospector's pack in the other and a six shooter fastened to his belt. But we think that after a few month's initiation, if he should stick to the game, the elaborateness of his outfit will have much diminished. As to the privations and hardships that he will have to undergo—it is altogether probable that most of them will be brought about by his own ignorance. It is a hardship to pack hundreds of pounds of useless dunnage over bad portages; but why take the useless dunnage? Would it not be better to sit down calmly and consider each article of the outfit in succession, discarding everything that it would seem possible to do without? The proper question is not "would this be of use to me?" There is hardly anything that is used by civilized man that might not come in useful in certain contingencies. Better far to say "would it not be possible to do without this?" To make something already included in the outfit serve a double purpose. If the answer should be in the affirmative, cast the said article aside without compunction.

The great mineral-bearing formation is, of course, the Huronian, and it would be well if every prospector made as careful a study as he could of this system. The writings of Messrs. Adams, Bell, Low, Miller and others, should be studied. These geologists have placed the Huronian above the Keewatin and below the Keweenawan. All these are, of course, pre-Cambrian, and hence very ancient formations. The silver ores of Cobalt are found in veins that traverse the lower Huronian; and the rocks of this series, consisting as they do, of conglomerates, breccias, quartzites and greywacke slates, should be studied very attentively. But the mineral-bearing veins do not seem to have been enriched excepting within a definite distance of masses of diabase, gabbro and other intrusives. As the patches of Huronian vary in size from a few feet to hundreds of square

miles, and are surrounded by unpromising Laurentian strata, it behooves the prospector to acquire at least a bowing acquaintance with them.

In conclusion, it may be said that while prospecting is a comparatively new occupation in Ontario and Quebec, it is full of promise, and one that will often repay those who enter upon its prosecution intelligently.

IRON ORES RESERVES.*

By Charles Kenneth Leith, Professor of Geology, University of Wisconsin.

The great increase in the world's annual consumption of iron, together with the attempts of large interests to acquire the known iron ore reserves, have led to careful inventories of the world's supply of iron ore, its rate of depletion, and to speculations as to further supplies. Estimates of the time of exhaustion of the present known supply have varied widely, but have shown startling agreement in the short time assigned. During the present year there have appeared several discussions of the subject which merit especial attention.†

Professor Törnebohm estimates for the Swedish government the iron ore reserves of the world by countries, based on detailed figures for the individual districts, as follows:

	Tons.	Metallic Iron. Per Cent.
United States	1,100,000,000	45 to 67
Great Britain	1,000,000,000	25 to 34
Germany	2,200,000,000	30 to 45
Spain	500,000,000	40 to 56
Russia and Finland	1,500,000,000	20 to 65
France	1,500,000,000	
Sweden	1,000,000,000	50 to 70
Austria-Hungary, Other countries	1,200,000,000	
Total	10,000,000,000	

Many will be surprised at the high figures given for the reserves in Great Britain and European countries. So much is heard of our own vast reserves and of the low grade of some of the foreign ores that we have come to think of the supply outside of North America as relatively small. The position of the United States is somewhat better than shown in the table when we take into account the grades of ore. By multiplying the figures by the average percentages of metallic iron given for each of the countries by Professor Törnebohm the result is as follows:

	Tons of Metallic Iron.
United States	603,166,600
Great Britain	295,000,000
Germany	825,000,000
Spain	249,375,000
Russia and Finland	637,500,000
Sweden	611,538,460

It is believed that the reserves for the United States, and hence the total, are higher than indicated in this table, but before taking up this question, we may consider conclusions that may be drawn from the figures as they stand.

President Hadfield of the British Iron and Steel Institute has prepared a diagram showing the world's increase of pig-iron consumption since the fifteenth century and the projection of this rate for the next century on the rate of the last thirty years. If the same rate of increase hold for the next century as has held for the last thirty years, in the year 2,000 the world's annual consumption of iron will be three and one-fourth times its present consumption. The total world's supply of iron ore now known, given as 10,000,000,000 tons by Törnebohm, will be exhausted in about fifty years. If the total be correct, about one quarter of the world's known reserves have been used to the present time.

It is argued that the calculated rate of increase is not improbable because of the increased rate per capita of the countries now using iron, because of the normal increase of the population of these countries, and because of the extension of the uses of iron through a much larger proportion of the world's population than now uses it (12½ per cent.). If 38 per cent. of the world's population were to require iron in the year 2,000, this would account for the calculated increase of consumption.

However, this additional part of the world's population, especially in Asia, may find its own iron ore supplies. No one would doubt that the world's reserves will be greatly increased by new discoveries in these relatively unexplored parts of the world.

Judging from the history of the development of the iron ore industry to the present time, the reserves of unexplored countries are likely to be developed only so fast as the population requires it. In this case, such new discoveries will not figure in the reserves available to the countries at present producing iron ore. The generalization might perhaps be made that each continent must ultimately depend on its own resources of iron ore and cannot count, to any large extent, on drawing supplies from other parts of the world.

It is of interest to apply the same method of calculation used for world's supply and consumption to the United States. If the rate of increase of consumption be projected for the next one hundred years on the basis of the increase for the past thirty years, that is, the period used by President Hadfield, and the lines superposed upon his diagram, it would appear that the rate of increase of production for the United States is greater than that of the world. Also the rate of production for the United States is greater than that of any other country. With the total reserve of iron

* Press reports of an address by the writer before the Chicago Geographic Society contain incorrect quotations concerning iron ore reserves. The substance of the writer's statements, so far as they touched on iron ore reserves, will be found in the accompanying paper, the purpose of which is to show that current estimates point to a short life for iron ore reserves, but that these estimates are low and, for the United States, do not take low grade ores sufficiently into account; that these low grade ores must be soon counted as a part of the reserves; that the increased use of low grade ores which this situation seems to call for will cause economic changes in matters related to the iron ore industry.

† Presidential address, by R. A. Hadfield. Delivered at the annual meeting of the Iron and Steel Institute at London, May 11, 1905. *Journ. Iron and Steel Inst.*, Vol. LXVII., No. 1, 1905, pp. 27-106.

"The Iron Ore Supply of the World," by Professor Alfred Tornebohm, *Teknisk Tidskrift*, September, 1905. Translated in *The Iron Age*, November 2, 1905, pp. 1158-1160.

"The Exhaustion of the World's Metals," by N. S. Shaler, *International Quarterly*, Vol. 11, 1905, pp. 230-247.

"A Word Survey of Iron and Steel, by J. Stephen Jeans, Secretary British Iron and Steel Institute.

"A Blue Book of Iron Ore Deposits in Foreign Countries," by Llewellyn Smith. Compiled at the Board of Trade from diplomatic and consular reports, London, 1905.

ore in the United States estimated by Törnebohm at 1,100,000,000 tons, the supply would be exhausted in less than twenty years if the calculated rate of increase of production holds. With the reserve estimated by Törnebohm, up to the present time 39 per cent. of our total supply has been used, and 29 per cent. has been produced during the last thirty years.

The late Edward Atkinson estimated that if the per capita consumption remains the same, the average annual increase in population of two millions for the United States calls for a yearly increase of pig iron of half a million tons, and that when the probable increase in per capita consumption is taken into account, the total production of the United States will increase at a considerably greater rate.

Professor Shaler concludes that the iron ore supplies of the United States are not likely to last for more than a century.

A great bulk of the known reserves of the United States is in the Lake Superior region. Törnebohm assigns a billion tons to the Lake Superior region, and these figures, while probably small, are in accord with many current estimates. In the producing Lake Superior iron districts exploration has, for the most part ,been sufficiently thorough to make it certain that no large increase of reserves is to be expected. In the Mesabi Range, for instance, thirty thousand drill holes and pits have been sunk. The Lake Superior iron districts, however, make up but a small proportion of the region tributary to Lake Superior, constituting less than four per cent. of the land area included in the United States Geological Survey's map of the Lake Superior region. In the remaining 96 per cent. there are still large possibilities for finding iron ores. The greatest of the ranges was discovered as late as 1891 and within the last four years two entirely new ranges have been found, though neither of them yet of the first importance. The geological conditions are such as to warrant the belief that more may be found. At the present time exploration in areas intervening between the ranges and in outlying areas is being pushed vigorously, showing the faith of iron men in further possibilities in this direction. The most sanguine, however, would scarcely hope to find ores equal in amount to those already known.

Lake Superior geological conditions are known to extend northward and northeastward through Ontario, suggesting an important source of supply here. The present known iron ore supply of this great region, counting even ores of low grade, does not equal the reserves of one of the older Lake Superior districts, such as the Marquette, but the country still to be explored is so vast that it is not unreasonable to suppose that important iron ranges such as those of the Lake Superior region may be found. Nevertheless, it is true that nowhere in the Lake Superior country where an equivalent amount of exploration has been done have the results been so disappointing.

When the present high grade deposits of this and other countries are exhausted, the future demand for iron ore is likely to be met by the use of far lower grades than are now considered commercially profitable. The term "ore" is a relative one. With the conditions in Alabama a rock containing 36 per cent. metallic iron may be mined as ore, while in the Lake Superior country such rock is now of no value as an ore. The ferruginous cherts and jaspilites, making up 95 per cent. or more of the iron formations of the Lake Superior region, average between 25 and 35 per cent. in metallic iron, and show all gradations into the iron ores. At the present time ores running below 45 per cent. are but rarely shipped. If the time should come when 30 per cent. ore could be used under the Lake Superior conditions, the tonnage available would be something enormous, perhaps twenty or more times as great as the present supply. It should be remembered that these ores are high in silica, and therefore not as desirable as ores of the same metallic content containing calcium carbonate in the gangue as do the Alabama ores. Moreover, the great distances from blast furnace centres, on the assumption that these remain approximately fixed, will put the low grade Lake Superior ores to a disadvantage in the matter of the cost of transportation.

Törnebohm estimates the amount of ore now available in the southern Appalachians at 60,000,000 tons. The Clinton red hematites make up the bulk of this tonnage. Drilling has shown that the presently worked deposits extend with slightly leaner but uniform composition in thin even beds over enormous areas, and it is altogether likely that the tonnage of these ores is many fold the figure given.* The ores are low grade and the cost of mining will greatly increase when the larger reserves are tapped.

The Clinton ores extend along the Appalachians into New York and appear again in Nova Scotia and Newfoundland. In each of these localities extensions are likely to be found. At Belle Isle, Newfoundland, approximately 30,000,000 tons of iron ore are available. This body is known to extend under the ocean, and if it can be successfully mined there, a large additional tonnage may be secured.

The brown ores of the eastern United States are difficult to estimate. They are usually low grade, mixed with clay, and often lie in thin and irregular beds, but the aggregate amount is large.

The magnetites of the Adirondacks and New Jersey are not included in Törnebohm's figures. Here again the tonnage is large, and if attempts at magnetic separation are successful on a large scale, as they seem likely to be, we have here another important source of iron ore which has not been taken into account in these estimates.

The titaniferous magnetites will be another important source of supply when they can be profitably smelted.

Unexploited iron ore deposits are widely distributed in the western United States and extravagant estimates of tonnage have been reported, frequently due to the fact that the basis of comparison has been the comparatively small size of the precious metal deposits of the West. The writer has examined deposits of reputed large size where the true tonnage seemed to him to be measured in units of thousands rather than millions or tens of millions. The grade of these deposits is on the average not high as compared with Lake Superior deposits and there is frequently a high percentage of phosphorus and sulphur. Nevertheless, there is in the aggregate through the western states a very large tonnage of iron ore of present commercial grade.

Among the better known deposits might be mentioned those in the Hartville district of Wyoming and in Fierro, New Mexico, both of which are now being drawn upon, in Pitkin, Chaffee, Saguache, Lake and Gunnison counties, Colorado, in Iron county, Utah, in northeastern Washington, and in a number of localities in the Great Basin region of Nevada and California. There should be included also the ores of Vancouver and Texada Islands in British Columbia, which are

* E. C. Eckel estimates 1,000,000,000 tons of red ore above the thousand-foot level in Alabama alone. (Engineering Magazine, Vol. XXX., 1906, p. 521.)

largely controlled by American capital and will be used in the United States. The same remarks may apply to the Durango and other Mexican deposits. With few exceptions, the western ores occur along the contacts of intrusive igneous rocks and limestone, and the extent to which the ores follow the contact in depth has not been shown. Hence the estimates of tonnage vary within very wide limits. The iron ore deposits of Iron county, Utah, are among the larger and most typical of this class of ores. Here some eight hundred pits have been sunk and it has been possible in recent detailed mapping to estimate with a reasonable approach to the truth the amount of ore of all grades appearing to the depth shown by explorations or natural exposures. Using the Utah deposits as a basis of comparison, and excluding the Mexican deposits which the writer has not seen, the tonnage of iron ore of all grades in each of the better known districts of the west and adjacent parts of British Columbia would not surpass that of one of the older Lake Superior ranges, but it is extremely likely that as deep exploration of the presently known deposits continues, and as further deposits are found, as they undoubtedly will be, that the aggregate tonnage of ore in the west will equal a considerable part of that of the Lake Superior region, and one would be rash to conclude that it is impossible that an amount of iron ore may be found in the west fully equivalent to that in the Lake Superior region.

If these data approximate the truth, there seems to be little cause of alarm that North America will really suffer for lack of iron ore for a considerably longer period than required for the exhaustion of the presently known tonnage, as estimated by Törnebohm and others, at the present rate of increase of production. The time of exhaustion is not likely to come before that calculated on the same basis for the world's reserves, and probably not then. It may be argued that the use of lower grade ores in Europe and England than in the United States is itself evidence that the exhaustion of reserves is farther in the future for the United States than for Europe or England. But as it becomes more and more obvious that the end of the supply of higher grade ores in the United States is not indefinitely in the future and may even be within a single lifetime, there is likely to be an increase in the tendency to conserve the higher grade ores, and especially the Bessemer ores, and draw more largely on the lower grade supplies, a tendency favored by the concentration of control in a few hands. This tendency has already become well defined as shown by the fact that pig iron production has not in recent years increased as rapidly as iron ore production. It is not at all unlikely that even the next decade may see important changes in this direction. This will give value to properly located low grade ores. It will ultimately mean higher cost for iron, changes in the relative importance of processes for conversion of iron, possible changes in the geographic distribution of different phases of the iron industry, and a modification of the relations of the North American iron trade with that of the rest of the world.

Professor Shaler concludes* that when the higher grade deposits of the world have been exhausted "the cost of production will gradually increase as the lower grade ores and those remote from coal come into use. In the end we shall have to resort to concentrating processes by which the iron ore is separated from the rock in which it is disseminated as grains. This upward grade in cost means a downward grade in the utility of the metal in the service of man. Finally, it may be some centuries from now, but surely we shall be forced to an economy in the use of the metal such as was exercised by folk two hundred years ago, when, save for what went down at sea, or rusted back to earth, none of it was lost to the arts. In this stage, when it becomes again a precious metal, iron may continue to be the helper of man for an indefinite period, but its power for help will be greatly diminished."

Others have reached similar conclusions as to the relatively early exhaustion of the ore deposits, few venturing to predict a longer life for the known deposits of more than one hundred years. The strenuous efforts of larger interests in recent years to secure ore deposits and to explore ore-bearing fields are evidence that the possibility of the early exhaustion of the ores is appreciated by many of the companies most concerned.

The situation is probably not so unfavorable as the above estimates would indicate. The assigned rate of increase of production may be too great, for the development of the iron industry of the United States for the past thirty years has been a phenomenal one. On the other hand, it is scarcely safe to predict a lessening rate of increase, for during the past fifty years it has been thought many times that the increase of rate was checked.

Törnebohm's estimate of the total reserves of iron ores for the United States is very conservative, and probably should be greatly increased. His estimate is confined to the producing districts and leaves out of account many important extensions of the ore deposits and districts, many known deposits of good size and quality not now mined because of location or other causes, and large reserves of ore which in the United States are regarded as too low grade to be of present commercial value, but really of a higher grade than ores counted in the English and German reserves. There should also be included the iron ore resources of Canada and Mexico immediately adjacent and accessible to the United States, already largely controlled by American capital and probably to be used in part in the United States.

The ultimate iron ore resources of North America are still far from known, but there may be no harm in reviewing our present imperfect state of knowledge concerning them.

International Quarterly, Vol. II, 1905, pp. 230-247.

ONCE MORE AFIELD.

Now that the summer is almost upon us, the staff of the Geological Survey are preparing for the season's field work. The appointment of a new director naturally creates more than ordinary interest this year as to how that work is to be apportioned. Several parties are being sent out, and every province of the Dominion seems to be fairly treated. Of the most important work to be done we cite the following items:—

INVESTIGATING NEW BRUNSWICK'S RESOURCES.

The area to be explored by Mr. R. A. A. Johnston in central and northwestern New Brunswick will be essentially confined to a narrow strip on either side of the proposed route of the National Transcontinental Railway. Trial lines have been run by the railway engineers over the whole distance, but the routes to be used over some sections have not been decided upon, more particularly the section from Grand Falls southeastward to the neighbourhood of Boiestown. The

work to be performed over the area in question will consist in an examination into its general geological and natural features and mineral resources.

In addition to the work thus cited, Mr. Johnston will, as opportunity permits, continue his investigations into the subject of Canadian meteorites, with a view to making the bulletin thereon as complete as possible. It is not at all improbable that several of these bodies are in the hands of private parties, where they remain merely as curios, and many more, no doubt, remain partially or wholly buried in the soil of the earth's crust.

Parties, therefore, knowing anything of the whereabouts of any of these bodies, or who may have such in their possession, would confer a great favour by communicating information regarding the same to Mr. Johnston without delay, by whom such favours will be greatly appreciated.

DEEP BORING IN NOVA SCOTIA.

Mr. Fletcher will visit and report on the borings being undertaken by private companies north of New Glasgow and elsewhere. It is the intention of the government to aid in the deep boring operations at New Glasgow and Mr. Fletcher will see that proper records are kept of the cores, and will also verify the depths sunk and the distance bored during the coming season.

The present depth of this boring, which is being put down by cable drill. is about 3,100 feet. The object of the work is to penetrate the conglomerate formation that is supposed to overlie (hereabout) the coal measures.

Application has been made by the Newfoundland Government for the services of Mr. Fletcher who, should the application be granted, wille examine the coal deposits of that island.

COAL IN THE ROCKIES.

Mr. Dowling will be employed during the coming season making explorations in the eastern portion of the Rocky Mountains, between the Red Deer River and the Athabaska. From the Red Deer the extreme northern end of the coal basin that is being mined as far south as Canmore, will be mapped out, and other basins within the above mentioned area will be sought for. It is in the disturbed area of the Rocky Mountains that the hardest and best coal is to be found, so that it is important to ascertain all the possible coal-bearing areas so situated.

The building of new lines of railroad through these northern passes has drawn attention to this very little explored portion.

IN SOUTHERN NEW BRUNSWICK.

The work about St. John, N.B., by Dr. Ells will comprise a detailed examination of the several geological formations there exposed. These range from the lowest crystallines, usually styled Laurentian, through Huronian and Cambrian, and, with some gaps, into the Lower Carboniferous. Certain of the Huronian rocks between the city and Loch Lomond resemble in character those of the Silver-Cobalt belt between Sudbury and the head of Lake Timiskaming, though no trace of economic minerals have yet been found in this part of the province. The Cambrian and Devonian rocks about the city are specially fossiliferous, and large collections have been made from time to time, more especially of the former, by Dr. G. F. Matthew, who has made a special study of these ancient fossiliferous rocks.

Geologically the field is a most interesting one. The map will be compiled on a scale of one mile to the inch, and will extend from the vicinity of Musquash harbour on the west to Black river and Loch Lomond on the east, while northward it will include the lower portion of Kingston peninsula.

GOLD IN NOVA SCOTIA.

E. R. Faribault will continue the examination and surveys of the gold-bearing rocks of Nova Scotia.

The revision of the structural geology of the region lying to the northwest of Halifax and extending to Windsor and Chester, will be made in order to prepare for publication the eight map-sheets completing the counties of Halifax and Hants. The surveys in Lunenburg and Queen's counties, already well advanced, will also be resumed. The surveys of the gold-mining districts of Miller lake and Clam harbour will be completed, and examination will be made in the gold-mining districts already mapped to bring the information concerning them to date so as to assist, by advice, in their future development.

Of Mr. Faribault's work, the "*Journal of Geology*" says: "This work will be of immediate practical advantage to mining men, some of whom have already testified to its accuracy and value. It is another instance, lately of frequent occurrence, of geological work done from a purely scientific standpoint having direct economic value. From a scientific standpoint also, the results are of interest as illustrating a principle of ore deposition in the form of saddle veins along antiolinal folds."

TO EXPLORE KEEWATIN.

Mr. McInnes will be engaged during the coming summer in an exploration of the country lying between the Saskatchewan and Upper Churchill rivers, for the purpose of ascertaining the general capabilities and possibilities of this section of country, both from geological and agricultural standpoints.

Particular attention will be given to the occurrence of economic minerals and to outlining any belts that in their lithological characters or geological relations are similar to known mineral-bearing areas in the east, such as the Sudbury and Cobalt districts.

This country is of special interest at the present time owing to the fact that the projected line of railway from the Saskatchewan to Hudson Bay passes through it.

HYDRAULICKING IN THE YUKON.

Urgent demands are being made upon the Dominion Government for assistance in expensive schemes of transporting water many miles in pipes to Bonanza and Hunker creeks in order to work hydraulicly the auriferous bench gravels found in the banks of these streams.

These water propositions are all "in the millions", and great care will be required to test their feasibility and value before the country is committed to granting them aid.

The Minister of the Interior, who visited the Yukon last summer, takes great interest in this matter, and in order to arrive at a proper understanding of the problem, is sending out a strong party from the Geological Survey with instructions to make as close an estimate as possible of the volume and value of the gold-bearing high level gravels remaining in the banks of the creeks.

Mr. McConnell, who has had several years' experience in Klondike, will be in charge of the party, and will be assisted by Messrs. Keele, Maclaren and O'Farrell. They will make accurate surveys of the banks by cross-sections and by digging test pits and drifts at close intervals along the sides of the valleys; in this manner, assisted by records of claims now being worked they will collect information sufficient to arrive at a close approximation of the cubic contents of the gravels remaining in the benches.

The valuation will be determined from the data already afforded by worked and working claims, supplemented by panning of the dirt from test holes and trenches.

Mining engineers who have visited the district claim that from 6 to 8 cents per cubic yard would give a payable return, and, in comparison to the small returns—sometimes only 2 and 3 cents—that are made profitable in the United States and New Zealand, these figures seem reasonable enough. Much, however, depends on the cost of transporting the water, and the frozen nature of the ground; the catchment basin is sixty miles from the area to be treated, the cost of pipes, dams and flumes wi' be immense, and until Mr. McConnell furnishes his report, it would be unwise to take a figure on which estimates could be based.

THE ROSSLAND DISTRICT.

The work of the Geological Survey party under the charge of Mr. Brock at Rossland is to be completed during the coming summer, and a monograph, accompanied by numerous maps, plans and illustrations on this important mining camp, will be published as soon as possible after the completion of the field work.

This is the first important investigation of a detailed character undertaken by the Survey, of a mining camp of British Columbia, and the excellent results already obtained from it will surely call for similar investigation of other important camps in that great mining province.

The investigations require an accurate topographical map of the Rossland area, and this is being made, on a large scale, by Mr. Boyd, while Dr. Young is carefully tracing out the intricate surface geology and collecting specimens of the almost endless variety of rocks found there; to map the position of these accurately it is necessary to examine almost every square yard of the surface.

To Mr. Brock is allotted the underground geology. This entails the careful examination of the walls of all the accessible openings and workings, old and new, in every mine on the camp; these shafts, levels and workings aggregate dozens of miles in length, and as the walls are everywhere covered with dirt and smoke, an examination can only be made foot by foot, by chipping fresh surfaces with the hammer. This work is not only tedious but often dangerous in those workings where the timbering has either been removed or has become rotten, and where a light tap of the hammer may bring down large masses of rock from the roof. The ladders in these old workings are liable to rot, and many a slip is occasioned in this manner.

The result of last season's work justifies the undertaking, showing as it does, that the enrichment of the ores came from below, and, in consequence, there is little danger of their value decreasing in depth, as happens when the enrichment of the veins is due to descending waters.

The investigations on the treatment of the lower grade ores point to a satisfactory solution of their treatment, and everything tends to show that Rossland will once more assume its old standing as a camp, but without the accompanying evils of a mining "boom."

The fortunes of this camp were, as is well known, at a particularly low ebb some two years ago, and both managers and directors were becoming discouraged. It does not in the least detract from the excellent work done by the mine managers when it is affirmed that it was largely on the advice and encouragement given by Mr. Brock that the present successful development and exploration work has been undertaken.

Mr. Brock's preliminary report has been printed, and is now being bound, and should be issued within a week.

FOSSILS—THEIR UTILITY.

Nearly every one now recognizes the fact than an intimate connection exists between a thorough scientific knowledge of the fossil remains of any series of sedimentary rocks and the economic results arising from geological study. Each set of rock deposits has its distinctive fossils, so that the greater our knowledge of the organic remains preserved in the rocks, the more readily can we distinguish the various geological horizons—a result of particular importance in this country in connection with the discovery of coal, petroleum and allied mineral products of commercial value.

Mr. Lawrence Lambe, Vertebrate Palæontologist to the Geological Survey, has in preparation a report on the fossil remains of the Oligocene deposits of the Cypress Hills, or in other words, on the animals, principally mammals, that lived in our western country during a past age known to geologist as the Oligocene or earliest Miocene period. Only remnants of the deposits then formed have escaped the action of the weather, and are found in isolated patches, of which one, capping the Cypress Hills in Southern Saskatchewan, has yielded the evidences of past life at present being studied. This part of the country then enjoyed a climate much milder than the present one, and was composed of plains and uplands, lowlands and forests with rivers flowing rapidly from the west and flooding the lowlands. The animals of this period were varied, and belonged to a number of groups. That the number of individuals in some of the groups was large is evident from the number of fossil remains of some forms. Some of the groups have since become extinct, others have undergone great changes, and are with difficulty recognized in their descendants of the present day, whilst a few now exist with but slight differences of form and structure. Included in the Cypress Hills collections are remains of ancient cat fishes, gar-pikes, and of a species like the modern mud-fish. Of reptiles there were land and water tortoises and river turtles, as well as lizards, snakes and crocodiles. Mammals, however, then preponderated as now, such as numerous kinds of hoofed mammals (Ungulates), to which ordinary English names are not applicable. Some of these may be briefly mentioned, however.

Among the even-toed Ungulates were a pig-like animal of large size, a distant relative of the true pigs; animals of the size of sheep that evidently lived in herds on the borders of lakes; small animals from which deer are supposed to be descended, with a number of other forms. The odd-toed Ungulates were represented by a variety of small primitive horses, swift running types of rhinoceros, also small hornless rhinoceroses with light limbs, and Titanotheres, extinct as a family, some forms of which were as large as elephants and which bore a pair of horns set transversely on the snout or in advance of the eyes. The squirrel family is represented, also early beavers and primitive hares.

The flesh-eaters included a number of primitive Carnivora, of which the largest and most powerful known left its remains in the Cypress Hills. Its jaw was more robust and stronger than that of any flesh-eater at present living.

Forms were also living that were the early representatives of our cat and dog tribes, and small insect-eating animals thrived. It may, in fact, be said that every class of animal now living had its primitive ancestors then on earth. From the latest collection of fossil vertebrate remains made by Mr. Lambe in the Cypress Hills beds, we have more than doubled the list of species known to have lived during Oligocene times in what is now part of western Canada.

During the coming summer Mr. Lambe will be engaged in examining certain Tertiary deposits of the southern interior of British Columbia with a view to gaining a better knowledge of their exact geological horizons. The fossils obtained will, it is hoped, form a desirable addition to the collections of the Survey, to be available later for exhibition purposes in the new building of the Geological Department.

COPPER DEPOSITS OF THE EASTERN TOWNSHIPS OF QUEBEC.*

By John Alexander Dresser.

INTRODUCTION.

The name "Eastern Townships" is applied to that portion of the Province of Quebec which is comprised in the northward extension of the Green Mountains into Canada. The hilly character of this district and its less accessible position delayed its settlement until nearly forty years after the cession of Canada to England. It was then surveyed according to the English mode of division of lands into townships that are approximately square, instead of the narrow oblong parishes of the French method of survey.

The Green mountains in Canada are sometimes known as the Notre Dame Hills. They determine the eastern edge of the flat St. Lawrence valley, and extend northeastward from the boundary line between Vermont and Quebec for a distance of about one hundred and fifty miles, or nearly to the latitude of Quebec City. The highlands of Gaspé, commonly called the Shickshock Mountains, are the extension of the White Mountains of New Hampshire, or of some more easterly range of the Appalachian system. From these the hill country of the Eastern Townships is separated by a considerable interval.

The main geological features of the district are three belts of crystalline rocks which are probably pre-Cambrian in age, separated by Paleozoic sediments, which are almost wholly of pre-Devonian age. These relations may be clearly understood by a glance at the map, Fig. 35. The crystalline rocks are composed of altered sediments, tuffs, and true igneous rocks. The igneous rocks consist of a series of porphyries and andesitic rocks, and of a serpentine-diabase series.

* From Economic Geology, Vol. I, No. 5, April, 1906.

THE ORE DEPOSITS.

MINING IN THE EASTERN TOWNSHIPS.

The occurrence of copper in the Eastern Townships was known as early as 1841, in which year Sir William Logan examined a copper property at Carbuncle Mountain, Brompton Lake. This was one year prior to the organization of the Canadian Geological Survey of which Logan was the first director.

In 1847 the Geological Survey report called attention to the deposits at Upton, and the reports of succeeding years mentioned or described other localities, until a compilation of those in 1866 gives a list of about five hundred localities in which copper was known to occur in the district. This mineral was vigorously sought for and extensively mined between the years 1859 and 1866. With the decline in the price of copper which followed this time, from about thirty-five to nine cents per pound, the mining operations received a very severe check and work for a time almost ceased.

In this earlier work copper was the only product of the ore that was of any considerable value, and the richest sulphide ores were discarded when the percentage of copper was low. After the intense speculative wave had passed, notwithstanding the low price of copper, between 1875 and 1885 several properties were reopened or changed management and were worked on a better economic basis. Not only were the metallic contents of the ores, except the iron, utilized, but the sulphur was also saved for the manufacture of sulphuric acid and allied products. Thus some of the reopened properties have been worked continuously for about thirty years, *i.e.*, ever since their operations have extended to the utilization of the sulphur. A depth of three thousand feet, or thereabouts, has been reached, and although detailed reports are not available, the continually increasing scale of operations at least indicates no diminishing of the works at these well-managed and successful mines.

CLASSIFICATION OF THE DEPOSITS.

The copper deposits of the Eastern Townships are of three distinct classes:

1. Ores, chiefly chalcopyrite, with small amounts of chalcocite and bornite, and relatively unimportant amounts of other ores, principally carbonates and pyrite. The ores of this class occur in the porphyry-andesite schists, the oldest rocks of the region. They form lenticular bodies, apparently occupying crevices, or more likely, have replaced the rock along lines of weakness produced in the course of the intense folding to which the region has been subjected. The gangue, when distinct from the country rock, is generally quartz, though sometimes calcite.

2. Chalcopyrite, bornite and chalcocite, with small amounts of carbonates compose the deposits of the second class. These occur as irregular bodies in Cambro-Silurian sediments where the latter are invaded by certain intrusives. The gangue is largely calcite.

3. Chalcopyrite in pyrrhotite, with a little pyrite, forms the third class. The deposits of this class are situated along the contact of Cambro-Silurian strata with the intrusive diabase of the serpentine series. They are distinguished from the ore bodies of the second class, not only by the character of the ore and the presence of pyrrhotite, but apparently also by the fact that the second group are generally exomorphic contact bodies, while the third are principally

endomorphic features of the contact. Moreover, the intrusives of the former are only dikes of comparatively small volume, but those of the latter class are large mountain-forming masses. The country rock of the second class of deposits is limestone wherever they have shown any important dimensions, with one possible exception, but in the third class it is an iron bearing slate or other metamorphic rock of the district.

A few of the characteristics of the ore bodies of the first class only will be presented in this paper.

CHALCOPYRITE AND PYRITE DEPOSITS.

Distribution.—The deposits of this class include the principal basis of work in the early development of the district, and of all the ore bodies that are at present exploited. They comprise three principal groups:—

(*a*) Some fifty mining properties and prospects, of more or less promise, in the township of Ascot, and other townships near the City of Sherbrooke. Amongst these are the Eustis, Capelton, King, Suffield, Ascot and other less known properties.

(*b*) The series of deposits long known to extend through the townships of Sutton, St. Armand, Bromo, Shefford, Ely, Melbourne, Cleveland, Shipton, Tingwick, Arthabaska, Chester, Ham, Wolfestown, Inverness and Leeds, as well as the divisions of the seigniory of St. Giles, known as the Handkerchief, and Ste. Marguerite in the county of Lotbinière.

(*c*) Deposits in the little known district along the boundary line between the province of Quebec and the state of Maine, south and east of Lake Megantic.

It may be seen by reference to the accompanying map (Fig. 35) that these groups are in the form of belts, which have a general northeasterly trend and are approximately parallel. For convenience they may be designated as the Sutton, the Ascot, and the Lake Megantic belts.

Dimensions and Relations to Enclosing Rocks.—In all cases the deposits occur in, or in close association with, altered volcanic rocks, generally of the porphyry class. The country rock is always highly folded, and often twisted and contorted to a remarkable degree, and this deformation gives to the ore deposits their characteristic shape. In form the deposits are much flattened lenses, which lie in conformity with the foliation of the rock. They are arranged *en échelon* generally along zones of extreme foliation. The individual lenses seldom exceed twenty or thirty feet in width, and bodies of these dimensions would be approximately two hundred to three hundred feet in length, according to approximate generalization from observation of a considerable number of the smaller lenses, and from the experience of miners who have worked out many of such bodies. The third axis, that nearest the vertical, follows the dip of the foliation, but its length relative to the other axis is not easy to ascertain, even approximately, since it is only these lenses which lie wholly beneath the surface, and which have been wholly worked out that can give data of any value, although a depth of nearly three thousand feet has been reached. Opportunities for such observation are necessarily rare. Experienced miners seem agreed that the dimension of these bodies in the direction of the dip is sometimes greater, at others less, than the horizontal axis, and some are of the opinion that it is generally greater.

The arrangement of the ore lenses *en échelon* is a matter of much importance in following the ore bodies. Thus in the Capelton district the miners have learned when a lens is exhausted to drift to the *right* to find the next. That is, that in proceeding along the strike towards the northeast, each succeeding lens appears on the southeast side of the previous one, *i.e.*, in the hanging wall, and in going towards the southwest the next ore body is to be looked for on the northwest, or in the foot wall. The dip here is from forty to seventy degrees towards the southeast.

The ore bodies correspond in their arrangement with the order of the hills of the district, and with the general structure of the Appalachian mountain system, in which each range when followed northward is succeeded by another lying to the east. It is evidently the same orthographic feature which gives the Atlantic coast its general northeasterly trend.

Though rarely, the ore bodies occasionally cross the planes of foliation of the country rock. They then have the aspect of veins running slightly oblique to the strike, or more rarely, to the dip of the enclosing rock. These vein-like masses are, however, of very limited extent, and are probably only the filling of local fractures between larger shearing planes. They are, perhaps, the better developed of the minor series of fracture joints.(1)

The walls of the ore bodies are not usually well defined, though one is usually more definite than the other. The ore, which consists essentially of chalcopyrite in pyrite, grows poorer towards the edges of the bodies where there are no definite walls, until the proportion of ore in the country rock becomes so small as to be imperceptible.

Origin of the Ore.—From the evidence at present available it can only be said that these ores were primarily brought in by the volcanics in which they are generally found; that the subsequent folding and shearing of the rocks developed planes of easier passage in which the subterranean waters, leaching out the metallic minerals from the rock, deposited them by replacement. The better preserved wall on one side of the ore bodies may be due to the fact that the rock on that side of the shear plane was more highly fractured than on the other, as is often the case. The greater replacement would thus take place on the fissile side of the water-bearing crevice. After the first film of ore had been deposited, a protection was afforded by it for the rock face on which it was deposited and all further replacement was likely to occur on the more fractured side.

The common occurrence of chalcopyrite in crevices within the pyrite, and as a thin layer upon a joint face seems to indicate that the chalcopyrite was introduced later than the pyrite. But of this there is not enough known as yet to speak decisively. Actual crystal replacement has not yet been observed.

Value of the Ores.—The average of a large number of assays of specimens from the south side of the Capelton hill, *i.e.*, from the Eustis and Capelton mines and other properties of the vicinity, showed the copper to range from 4 per cent. to 5 per cent., sulphur, 38 per cent. to 40 per cent., and approximately one ounce of silver to each unit of sulphur, with small amounts of gold.(2)

A number of assays of recent date from the north side of the same hill, from the Suffield, King and other properties, give a lower percentage of sulphur, but higher metallic values, especially of silver, which here seems to vary without regard to the sulphur. Gold is here commonly present to the amount of $2.00 to $4.00 per ton. As a very general statement the

(1) J. B. Woodworth, *Proc. Boston Society of Natural History*, Vol. XVIII., p. 391, 1896.

(2) Dr. R. W. Ells, Geol. Survey of Canada, 1888-9, p. 53 K.

ores of this class of deposits may be said to carry 4 per cent. of copper, 35 per cent. of sulphur, near the surface, and at greater depths to yield uniformly 3 per cent. of copper, 45 per cent. of sulphur, three ounces of silver, and small amounts of gold.

Gold, which does not seem to be present in appreciable amounts at lower levels, is often an important factor near the surface. Alluvial gold occurs in many of the streams which run over copper-bearing rocks, and the surface rocks yield it in many places. At a depth of a few feet from the surface most such gold prospects have been abandoned, but in one or two notable instances they have developed into copper mines, the copper values increasing as the gold values declined.

Secondary Enrichment.—Although it has not yet been found possible to get information sufficiently definite and accurate to make a satisfactory comparison of the ores at different depths, there appears to be a slightly higher copper, and distinctly greater gold value, near the surface, than at a depth of a few hundred feet. This richer zone seems to be deeper but less well marked in the case of copper than of gold. The information available, however, is insufficient as yet to admit of safe generalization. At present it can only be said that there probably are such zones, that they are presumably due to secondary enrichment, and that any such enrichment has taken place from above, and hence by means of descending waters. The evidences that both the iron and the copper sulphides were deposited in their present position after the foliation of the country rock began have been already noted.

Source of the Copper.—The source of the copper and other metallic minerals seems undoubtedly to be the volcanic rocks. The principal deposits occur wholly within these rocks, smaller bodies, however, being not infrequently found along the contact of the volcanics with an overlying dolomite. In such cases the copper has evidently been deposited contemporaneously with the dolomite, which it more or less strongly impregnates for a distance of a few feet only from the volcanic rock.

It was recognized by Logan that the copper deposits were derived from the country rock(1). But, on the assumption that the country rock was of aqueous origin, these were regarded by him as an excellent example of sedimentary mineral deposits. He thus summarizes his views.(2) "The evidence which has been presented in the description of the copper deposits of the Quebec Group, appears to show that the metal, like the iron, manganese, nickel and chrome, which so often accompany it throughout these rocks, was held in solution by the waters from which the sediments of the period were deposited. By the agency probably of organic matter it was reduced to the condition of a sulphuret and precipitated with the sediments, either in a finely divided state, or more frequently, in small nodules, or patches, which became interstratified with the limestones, the slates, the diorites and the other rocks of the series. A subsequent action, probably contemporaneous with that which has metamorphosed and crystallized the rocks over a great part of their extent, dissolved out portions of the copper sulphurets from these beds, and in certain cases deposited them with quartz and various spars, in the fissures of the rocks, giving rise to the veins or courses which have been described.

(1) "Geology of Canada," 1863, pp. 734–5.
(2) "Geology of Canada," 1863, p. 734 et seq.

"There appear to be in this region no facts to sustain the ancient notion of the connection of metalliferous deposits with eruptive rocks which are absent from great portions of the district."

With the knowledge that the country rock is eruptive, the above opinion becomes open to reconsideration. And since there seems to be no doubt that the copper has been derived from the country rock, these lodes can only be regarded as deposits genetically connected with volcanic rocks and the earlier view is thus completely reversed.

MORE NOTES ON STAMP MILL PRACTICE*

By Courtenay de Kalb, New York.

This paper may be considered correlative to one on the same subject published in the Transactions of the Canadian Mining Institute, six years ago, representing more varied experience, confirmatory of some of the opinions then expressed, and destructive of others.

SCREENS.

The unwisdom of depending too much upon the diameter of screen opening to determine size of pulp must be again insisted upon. Height of discharge and quantity of feed water are the best regulators. The diameter of screen opening is never constant, owing to wear, and the difference of every 1,000th of an inch is vital. The skilful batteryman will, with a well-mixed (bedded) ore maintain a uniform product throughout the mill, though conditions of weight of stamps and diameter of screen openings may vary widely in the different batteries. Every mill should be provided with at least three testing screens, one having openings equal to the diameter of the maximum size of grain admissible for the ore under treatment, one having an opening equal to the middle-sized product desired, and the third of the finest accurate screen made, which is No. 150 mesh, or about .00876 millimeter diameter of opening. The product from every battery should be tested at frequent intervals by wet screening. When the pulp on the coarsest screen exceeds a half of one per cent. the battery screen in that battery should be changed, or extraction will suffer. The ratio between the middle-coarse and the middle-fine should be nearly constant and uniform throughout the entire mill, and above all a constant ratio by weight between the total oversize and undersize material from the finest screen must be carefully maintained. These ratios should be made the subject of regular reports on the amalgamator's report-sheet to the manager, the same as the daily assays. They are equally as important, for, while the latter indicate values, these ratios have a definite and vital relation to the percentage of extraction which may be anticipated. It is a good plan to throw the responsibility for the screening upon the amalgamator, and for drying, weighing and reporting, upon the assayer.

The perfect screen does not yet exist. Die-cut Russia iron still stands unexcelled for most ores. As a screen should, in the author's opinion, be used as far as practicable chiefly to prevent the escape of

* This paper was read at the annual meeting of the Canadian Mining Institute, Quebec, March, 1906.

grains larger than the pre-determined maximum which can be economically treated, the larger the ratio of open-space to blank metal in the screen the better, and the openings should be so disposed as to facilitate discharge to the utmost. For limiting discharge, regulate weight of drop, height of discharge, and quantity of water. The "herringbone" pattern of diagonal-slot punched Russia iron screens, has been found, in my experience, to combine in the highest degree this advantage, coupled with good wearing power. The Tyler rolled wire screens gives a better discharging surface, but the crown of the mesh is the thinnest and weakest portion in this screen, instead of being the heaviest, and its life is correspondingly shortened. If this screen can be made with the crowns electrically welded, it will be a great boom to the millman. The tendency of the woven-wire screen to clog does not apply to any serious extent to the rolled wire screen.

FOUNDATIONS.

My personal experience with concrete mortar foundations has led me to regard them with disfavor. The surface must be very smooth. It is unsafe to compensate for unevenness in the set of the concrete against a "form," by grouting, as this gives a bearing surface of uneven density. The tendency of concrete mortar-blocks to wear rapidly and unevenly seems irremediable, and will so remain until some one can devise a lock-nut for foundation bolts insuring absolute rigidity. A rubber cushion directly between the mortar and the concrete is a mistake, and in fact merely invites rapid wear, since the inevitable prominences on the concrete surface compress the rubber at those points inducing excessive wear, so that destruction of the cushion soon ensues. Anvil blocks between the mortar and the concrete block increase the difficulty of rigidly anchoring the mortar, and exaggerate enormously the evil tendency of the concrete block to induce breakage of stems. Having had opportunity to compare the behavior of batteries mounted on concrete and on built-up wooden blocks in the same mill, crushing identical ore, and this in two different mills in separate districts, I have in each instance found the ratio of broken stems to be as 1 to 3 in favor of built-up wooden blocks. I have been led to adopt as best a rock or concrete bottom, accurately dressed smooth and level to a straight edge in every direction, as a support for a built-up block of 2″ x 10″ creosoted white or sugar pine, spiked together, not less than 12′, nor more than 14′ in height, dressed smooth on top and carrying a ¼″ best grade pure Para gum sheet as a cushion against the mortar. Such blocks are good for 8 to 10 years, even where drainage of block-pits is not good. To reduce the wear of concrete blocks I have employed with marked success a facing of ¼″ wrought iron sheet, at least 4″ wider than the width of the mortar base, and 2″ larger. This effectually stops the wear of the sharp edge of the mortar on the concrete if any nuts loosen, and it furnishes a suitable surface for the rubber cushion. This comes very near eliminating the disadvantages of the concrete block, but nuts on foundation bolts will loosen quicker than with wooden blocks, and more stems will break on concrete.

STAMP DUTY.

Stamp duty is relative, depending not only on the character of the ore, but on the rate of discharge which has been found to give the most economical results. The metallurgist who has not advanced to the point of tolerating the low crushing efficiency per H.P. of the stamp mill for the sake of the extraction by amalgamation which he can make it yield, is in error at the very foundation of the trade. If you are not getting your large recovery of gold values inside your batteries, there is something wrong with your methods, or else you ought not to be using a stamp mill, and your whole process needs study and revision. It should be borne in mind that it is not necessarily the mill man who can put through the largest tonnage who is earning the most money. As an example, in a recent experience in California I found that I could obtain a recovery of 91.5% when crushing 0.121 ton per stamp per hour; and that using the same screen (0.028 in. diam. of opening) but readjusting the mill as to drop, discharge, etc., the duty could be run up to 0.188 ton per stamp-hour, with a reduction of the recovery to 77%.

MORTAR LINERS.

A long and trying experience with mortar liners has led to my abandonment of this attractive adjunct to a mill. Theoretically it should be possible by the use of liners to have at command an adjustment of the width and depth of the mortar, thus giving that flexibility which would enable it to meet changing characters of ore. Practically I have found that such great inequalities of wear of the mortar are induced by liners that ere long it is impossible to hold them in place, and so far as the bottom-liner is concerned it becomes a sort of teeter-board, and throws the whole line of dies to one or the other end of the mortar, inducing cupping, and destruction of the ends of the mortar shell itself. A good hard gray-iron mortar, with a base 9″ thick, and ends at least 2¼″ thick to a height of 10″ above the mortar-lip, is the best that can be had. In order to quote low prices, manufacturers design mortars with scanty metal on base and sides. Insist on plenty of metal; it costs little, while demurrage of your mill later on may destroy your profit and ruin your chances of success. In general the narrow mortar of moderate depth (say 14″ wide and 6″ deep at the lip) is the most satisfactory, in that it will fit more cases. The chuck blocks will then do the rest.

SHOES AND DIES.

While admitting that no rule may be established for all ores as to the best type of shoe and die, I may set forth as the result of my own practice that I find in the great majority of cases the longest life, highest duty, and most uniform and economical wear, are obtained by shoes and dies made as follows: dies, with one inch base, forged steel, made from open-hearth ingots of "80 carbon" (i.e., 0.8% carbon) forged at dark yellow, bases subsequently annealed; shoes, open-hearth "60 carbon" steel, forged at bright cherry, necks annealed. Shoes and dies made according to these specifications year in and year out have worn respectively until the die was ¾″ to 1″ thick, and the remnant of the shoe was a plaster of steel ⅛″ to $\frac{1}{16}$″ thick on the end of the boss-head; cupping being so rare as to arouse the gravest suspicions of inattention to duty on the part of the amalgamators. The die should be more highly elastic than the shoe, because the crushing of the ore particles in stamp milling is done as a result of the reaction from the resilient die, the waves of compression transmitted through the particle from the shoe being reflected from the die, and the strains set up by the on-coming and the reflected waves, exceed the elastic limit of the particle, and

rupture, to the point even of comminution results. Place two steel bars ½" thick on a new die, with a 1" fairly round ore particle between, and let a newly shod stamp drop on it. You will find a number of irregular fragments of varying sizes, with a small conical pile of ore-powder resting on the die very highly compressed in the centre so as to be often adherent to the die. This experiment not unfairly represents what occurs in practice, where the blow delivered upon the protruding larger masses of ore is checked by the expenditure of work in compression of ore particles, until the momentum is overcome by the increasing resistance of the number of uncrushed particles relatively to the remaining kinectic energy of the falling stamp. The crushing of the finer particles, which can never be reached by the stamp, owing to this masking of its blow, is manifestly due to attrition in the mass of pulp, and to minor blows transmitted from the stamp through ore-particles to smaller pieces between these and the die. It is interesting to observe that the percentage of pulp produced in the above experiment, crushing single particles, which will pass through a 0.00876 m.m. opening is roughly 22%, while in ordinary work a mill will produce from 28 to 40% of pulp of this grade.

INSIDE AMALGAMATION.

In some mills the bulk of the amalgam recovered from the batteries is found in the sands; in the Yellow Aster (Cal.) mill, it tends to form hard balls in the corners of the mortar, but this is a rare though not exceptional case. Ordinarily the "catch" is mainly on the plates. It is always good practice to use a chuck plate, unless it persistently scours to have copper. What is caught on this plate is so much to the good, and it costs but little to get it. Usually it is a very productive plate, and should yield hard amalgam in ridges, often a half inch high. It is easier to secure good work on the back plate. Scour will occur sometimes, in spite of careful work, due to unavoidable changes in the mineralogical composition of the ore, rendering the pulp either more or less mobile, and either condition may be a predisposing cause. The tappets may be re-set to compensate, and regulate the splash to check the scouring, but if plates have begun to catch, and then start to scour, it is safer to remove them at once, substituting new ores, and then readjust to bring the splash back to proper form. It is unsafe to count on re-catching scoured amalgam on the outside plates. The inside amalgam should be hard and dry, and such amalgam breaks up into thin scales and spicules which float most persistently. The regulation of the splash is all-important. Even when, as seen through the screen, the splash appears to be an even oscillation or wave-motion across the mortar, it may in fact be scouring. If the plates show much bare copper it means a loss, for amalgam is certainly forming, and is equally being worn away, much of which is inevitably lost. The inside plates must be coated with amalgam, or else they are a disadvantage. The adjustment of a battery to avoid scour cannot be made in a perfunctory manner, nor can it be done according to rule. It is only in rare cases that every stamp in a battery can be set to the same drop, and good results obtained. After a clean up they must be set that way, with the centre stamp having a little higher drop than the others. Then one by one each stamp must be reset until all tendency to scour is overcome. Even then they must be watched, and re-set as the shoes and dies wear, and as the chuck block is dropped, giving a narrower space in which the crushing must be done. If scour is persistent, in spite of such vigilance, it indicates either that the plates are too near or too far from the dies, or that the sands are too mobile ("quick") or too heavy ("dead"). The latter difficulties may be overcome by changing the ore mixtures, which in most mines can be accomplished if enough stoping ground is blocked out. Sometimes a change in the quantity of feed water is all that is necessary. Another difficulty is the obstinacy of many amalgamators who will not attend to all these details, who expect a mill to run itself, and refuse to be taught better. Such men are too expensive to keep.

CONSTANT ORE MIXTURES.

The bedding of ores, so as to secure proper mixtures, giving the best results in milling is almost as important in amalgamation as in smelting; but as the physical character of the pulp is the important thing, which no analysis can foretell, it will not do to "stock" in the bedding-bins too far in advance of the mill-needs. It is better to have ore of different characters broken and ready in the chutes, to be drawn upon as needed.

DRESSING OUTSIDE PLATES.

The experienced amalgamator will never allow discoloration to begin upon the outside plates. The preventive, as well as the remedy, is hard, brisk, rubbing with whisk brooms. Discolored plates indicate laziness, inattention to duty! A dark, crusted deposit, however, indicates antimony, for which there is no effective remedy but to find where the ores carrying it come from, and omit running those blocks of ore which give trouble to mill. It is usual to find antimony segregated into chutes or bunches, at least to such an extent that the difficulty may be minimized by intelligent management.

To clean plates borax soap is altogether the best material to use under modern conditions. It is sufficiently alkaline to clean off any stray animal fats, and it will emulsify the mineral oils, and leave the plates bright and ready to take mercury or catch-gold. Caustic alkalies no longer have any legimate place in the amalgamator's stock of supplies. They do not touch the mineral oils, and practically all modern lubricants are petroleum derivatives. Cyanide of potash should never beused under any pretext. It hardens the amalgam and causes it to scale. If bare copper occurs, from any cause, scour with sand, wash with borax soap, rinse, swab with a solution of mercuric chloride (corrosive sublimate) rinse, well, and burnish with a dry cloth. A surface so prepared will promptly start to catching amalgam.

USE OF SALTS WITH COPPERY ORES.

If the ores carry copper sulphides, copper sulphate will usually be present also, or will be formed to some extent in the battery. This may be largely decomposed and the copper amalgamated with the gold, by feeding common salt with the ore. This may be due to the normal reaction between the copper sulphate and the metallic iron in the battery, the salt serving merely to facilitate the reactions and amalgamation by increasing the conductivity of the solution. Further chemical phenomena may be involved, but I have as yet had no opportunity to study the situation critically in the laboratory. This practice is often useful in protecting the cyanide treatment of the mill sands.

OUTSIDE AMALGAMATION.

The hardness of the amalgam for good work no man can determine in advance for any ore. The right consistency must be found out by actual trial in each mill. Usually a granular, frosty appearance, with a softness such that the fleshy part of the thumb can just make an impression, is most likely to give the best results. Abundant area of copper plate beyond the battery is important. Most mills are deficient in this regard. It pays to have enough. Forty eight square feet for each battery may be taken as the minimum and beyond this use as much as pays. There is no advantage in using copper plates plated with more than 1 oz. silver per sq. ft. In fact, more than this is a positive disadvantage. A good amalgamator can build up amalgam on raw copper without difficulty and, keep his plates bright and fresh. The chief advantage in silver plating is to reduce the absorption of gold by the plate. A first dressing on bare copper with dilute silver amalgam will yield a surface more sensitive as an amalgam-catcher than a silver-plated copper plate.

The foregoing statements have been made with the positiveness of conviction resulting from successes in practice wrung out of trying situations, but with no thought that the final word has been uttered, and the author hopes to stimulate criticism and call forth new confessions of experience, to the betterment of his own and others' metallurgical methods.

THE CYANIDE TREATMENT OF CUPRIFEROUS TAILINGS BY THE SULPHURIC ACID PROCESS.*

By W. S. Brown.

The following notes on the sulphuric acid process as applied to the treatment of a cupriferous ore may be interesting for comparison with the results of laboratory experiments on the use of Ammonia and its compounds in cyaniding cupriferous ores, recently contributed by Messrs. Jarman and Brereton.

The ore here referred to, in which the copper is present as carbonate, came principally from the Cobar Chesney Mine, Cobar, N.S.W., and was crushed in that Company's old battery many years ago. The tailings remained on the dump until purchased by Mr. Askin Nicholas, in February, 1903.

Separate acid vats were provided for the preliminary acid treatment. In the operations under review, these vats were shallow rectangular wooden vats each holding about 25 tons of tailings.

The cyanide vats held 75 tons of tailings, so that the contents of three acid vats were treated and subsequently loaded into one cyanide vat. This allowed of a proper adjustment of time of treatment for continuous working and the small acid vats reduced the risk of defective treatment.

On an acid vat being loaded, ten to twelve tons of dilute H_2SO_4 solution were pumped on. As soon as the vat was full of solution, covering over the ore for some inches, the bottom valve was opened and the spent solution allowed to drain off slowly through a launder to the copper precipitation boxes. When the solution had drained so as to show the ore on top of the vat, the bottom valve was again closed for an hour or so and the acid allowed to remain in contact. This first solution when drained off never showed free acid.

On again opening the bottom valve, the balance of the acid solution was allowed to percolate, usually at the rate of about two tons an hour, and flowed directly through the copper precipitation boxes to the sump, for making up again with H_2SO_4, or to waste.

The acid solution was followed immediately by a first water wash equal in tons to the original solution, which flowed into the vat from a tank above at the same rate as the vat was draining. This wash was followed by a clean water wash of about half the quantity and the vat was allowed to drain for discharge, the total time of treatment being 48 hours.

All the acid solution and wash passed through the copper precipitation boxes, and was either used over again or run to waste, depending on the supply of water available. The final wash was always clean water.

When these operations were complete and the vat ready for discharge, 0.5% to 0.8% of lime was distributed over the surface and discharged with the sands, ensuring a fairly intimate mixture.

The acid solution was made up afresh for each vat, and its strength determined from a sample of the sands drawn during loading.

A portion of this sample was agitated for half an hour with a standard 1.5% H_2SO_4 solution, and the consumption of acid determined by titrating with standard Na_2CO_3.

The weight of acid consumed in lb. per ton of sands was then calculated, which, multiplied by the number of tons, gave the total acid required for the vat. To this an excess quantity of 25% was commonly allowed and the weighed acid then added to the sump, well stirred up and pumped on. The pump employed was a Pemberthy steam ejector, which answered extremely well, and lead piping was used.

The copper was precipitated from solutions by passing through two boxes 10 ft. x 3 ft. x 4 ft., each divided into four compartments as in the ordinary zinc boxes. These boxes were filled with scrap sheet iron, obtained locally in the shape of old tins which had been burnt for recovery of the solder, and were to be had for the cost of carting.

The precipitation of Cu on the large surface of iron thus exposed was practically perfect. On the other hand, all free acid entering the boxes was consumed at the expense of the iron.

Before the lime was added, and the vat discharged, a second sample was drawn from the sands. On this sample a determination of cyanide consumption was effected by agitating for half an hour with a 0.3% KCy solution with addition of 0.5 % of lime.

For some time an effort was made to determine the acidity on this sample for regulation of the quantity of lime required, but for various reasons it was found better to add 0.5% lime as a minimum. In special instances additional lime was added.

No regular record was kept of the Cu remaining as a residue after acid treatment, but as a rule the extraction was almost complete. With slimes present in sufficient quantity or unevenly distributed through the sands so as to interfere with percolation, of course the results were not so good.

From the acid vats the sands were trucked to the 75-ton cyanide vats for ordinary treatment.

Fifteen tons of weak KCy solution were first applied to displace the approximate 15 tons brought as moisture from the acid vats. This first fifteen tons carried little gold. As a rule about 12 tons would come through carrying only traces, and the other three tons would vary according to the relative perfection of the displacement. In any case the first 15 tons were carefully isolated in a special sump and eventually used as a

* A paper read before the Institution of Mining and Metallurgy, London, March 15, 1906.

final wash for the outgoing residues. This solution passed slowly through a zinc box, and then through about 20 cub. ft. of packed charcoal.

The zinc precipitation was not effective unless free KCy was present, showing defective displacement in the vat, in which case there would be high gold values in the solution, but when no free KCy was present and but little gold, the charcoal always caught some, if not all. If assays showed that more than a few grains of gold were still present and precipitation had been imperfect, the solution was again passed through a freshly made-up zinc box, with addition of KCy, before being finally used up as a wash.

The first weak solution was allowed to drain off entirely and was then followed by solution made up to 0.3% KCy. Several applications of this strength were made, in all between 50 and 60 tons being pumped on, but between each application the sands were allowed to drain dry, the outlet valve being only closed when a fresh lot of solution was going on.

Between 20 and 30 tons of weak solution followed, and finally the 15 tons of wash.

The following statement shows the actual working on these lines, and covers the period of from 1st to 16th October:—

in excess of the actual requirement per ton of sands.

The copper present averages 0.32%, or equal to 1.44 tons for 450 tons, 7.1 lb. per ton.

Cyanide consumption is shown as 0.72%, or 1.6 lb. per ton.

From costs taken over several months—

Scrap Iron averaged	1.5*d.*	per ton.
Lime	"	3.6	"
Zinc	"	2.0	"

The quantity of acid used—4.5 lb. per ton, in excess of consumption on the ore—is open to criticism, and could to a great extent have been obviated by a better arrangement. Instead of passing the acid solution direct to the copper precipitation boxes, where the excess of free acid was consumed by the iron, it might have been sent to a sump and re-strengthened for a second application, or used as a preliminary wash on the next vat, and only passed through the precipitation boxes when showing no free acid. Under the circumstances in which the work was performed, it was considered economical to sacrifice acid and iron for other considerations.

The cement copper recovered was readily disposed of, although perhaps at a low price, since the total

STATEMENT OF WORKING FROM OCTOBER 1ST TO 16TH.

Date	No. of Vat, Acid.	% Acid.	% Cu.	Lb. Acid Required	Lb. Acid Applied.	Date Discharged.	% KCy Consumed	Date Loaded	Vat No., Cyanide	Assay Sands.	Date Discharged.	Assay Residues.	Recovery Per Ton.	Oz. Gold.	% Recovery	Notes.
Sept.						Sept.		Sept.		Dwt. gr.	Oct.	Dwt. gr.	Dwt. gr.			
21	I	54	13	324	486	23	.06	..								
22	II	.64	25	384	576	24	.05	..								
23	III	.58	34	348	522	25	.04	25	I	9 17	1	1 17	8 0	30.00	82.4	A
24	I	.58	.37	348	522	26	.08	..								
25	II	.58	.32	348	450	27	.05	..								
26	III	.74	40	444	666	28	.04	29	II	9 23	4	2 8	7 15	28.50	76.6	B
28	I	70	27	420	525	30	.07	..								
29	II	.64	.30	384	480	30	.04	..								
						Oct.		Oct.								
30	III	.70	.40	420	522	1	.05	1	I	8 14	8	1 14	7 0	26.25	81.0	C
Oct.																
1	I	.43	.14	288	432	3	.08	..								
1	II	.89	.50	540	675	3	.11	..								
2	III	.84	.52	504	680	4	.06	4	III	9 20	12	1 15	8 5	30.75	83.9	D
3	I	.72	.40	432	540	6	.11	..								
3	II	.78	.40	468	585	6	.07	6	II	9 11	14	1 12	7 23	29.85	84.2	E
4	III	.58	.29	348	522	7	.09	..								
5	I	.66	.29	396	594	8	.09	..								
6	II	.32	.07	192	280	8	.13	8	I	7 15	16	1 16	5 23	22.35	78.7	F
	..	.65	.32	6588	9057	..	.072	..	..	9 4	..	1 17	7 11	167.70	81.1	..

.1.—Fair extraction. .25% average Cu, and .05% average KCy consumption. Six days' cyanide treatment.

B.—Poor extraction. Only five days' cyanide treatment.

C.—Fair extraction. .32% Cu. Seven days' cyanide treatment.

D and *E.*—Good extractions. .39% Cu. Only five acid vats were treated for the two cyanide vats, some acid treated material having accumulated. Eight days' cyanide treatment.

F.—Poor extractions due to slimes and imperfect acid treatment. Over .1% KCy consumption. Eight days' cyanide treatment.

From the 450 tons treated during this period, 1677. oz. of gold are theoretically shown as recovered. The actual recovery over a period of nine months was about 1% in excess.

The average value of the sands treated is shown as 9 dwt. 4 gr., of which 7 dwt. 11 gr. is recovered, leaving 1 dwt. 17 gr. in the residues, equal to an extraction of 81.1%.

The average theoretical strength of acid required per ton is shown as 0 65% H_2SO_4, equal to 165. lb., of 92% acid.

The theoretical quantity of acid called for is 6588 lb., a difference of 1 lb. per ton coming in on correction of tonnage treated.

The quantity actually consumed is 9057 lb. of 92% H_2SO_4, equal to 20.1 lb. per ton treated, or 4.5 lb.

tonnage was small. Shipments averaged about 60% Cu, the balance being iron and silica.

No serious difficulty was found in getting a reasonable extraction of the gold from the acid-treated sands. The first experiment showed a possible extraction of only 65%, with six days' treatment, but this was found to be due to lack of aëration. While experimenting with various oxidizers it was discovered that sufficient aëration could be obtained by applying the solutions as before described. In practice the solutions were well circulated in the sumps, and the usual provision made of allowing the pump suction to draw a little air.

The working solutions seldom showed over 0.3% Cu, and usually were much lower. When, as latterly, more slimes had to be treated in the charges, conditions

were not so favorable and more Cu had to be dealt with in the cyanide treatment. The zinc boxes then required careful attention, and the endeavor was to get as clean a precipitation of copper, as well as of gold, as was possible. Lead acetate was freely used and the boxes freshly made up at close intervals. No cyanide solutions were at any time discarded. When the solutions were foul they were always high in gold contents, and as the precipitation of the gold was accompanied by precipitation of the copper, re-aëration restored their working usefulness.

With frequently-fouling solutions it would probably have been economical to adopt the system of precipitation as suggested by H. A. Barker,* using HS_2O_4 to precipitate Cu in the sump, decanting off and recovering the liberated HCN by addition of caustic soda.

The product of the zinc boxes was extremely base, both from the Cu precipitated and the Pb employed to assist that precipitation. In the clean-up after solution and removal of Zn by H_2SO_4 and careful washing with distilled water, HNO_3 was used to remove Cu and Pb. This latter operation had to be performed with considerable care to avoid getting gold into solution.

All solutions employed in the clean up, including washes, were decanted into storage tanks and held until their values had been determined by assay. By using distilled water throughout and precipitating any chlorides with silver, no difficulty was experienced in producing bullion over 900 fine without loss. The ore itself carried very little silver.

Some experimental work was done on the separate treatment of the slimes in the heap of tailings. Naturally the acid process does not lend itself to any system of decantation for subsequent cyanide treatment. Filter pressing, involving special presses, and double treatment, would probably have given high extractions but was out of the question in view of the limited quantity of slimes available.

Among other experiments on the ore, it was noted that by a preliminary roasting the consumption of cyanide was reduced from 0.5% to .08%, but it was decided that, on account of the small tonnage available, the slimes could be most economically treated by judiciously working them in with the sands in the acid treatment by percolation.

The writer's thanks are due to Messrs. Nicholas & Nicols of Melbourne for permission to publish these details.

* *Trans.*, vol. xii, pp. 399-401.

EXPERIMENTING WITH BLACK SANDS.

The last congress of the United States authorized the investigation of the black sands found in the placer mines of the United States; this investigation to be under the supervision of the director of the United States Geological Survey. Dr. David T. Day was given charge of the work, and a preliminary circular letter was sent to all the known placer miners of the United States, some 8000 in number. The circular was worded as follows:—

"Within the last few years much enquiry has been made concerning various minerals occurring in the heavy sands (so-called "black sands") which collect in the riffles in placer mining. The Geological Survey has therefore undertaken an exhaustive examination of all the minerals contained in the placer deposits of the United States.

"It is proposed to collect the heavy sands from all placer mines in the United States where evidence of platinum has been found by preliminary tests. The samples thus obtained will be used in determining the best methods of extracting the various minerals which have economic value. It is hoped that in many places the separation and sale of these useful minerals, such as magnetite, chromite, garnet, monazite, rutile, topaz, zircon, gold, platinum, iridosmine, etc., will become a permanent and profitable industry.

"As a preliminary step in this investigation you are cordially invited to mail to this office, not more than 4 pounds of material most likely to contain platinum in your placer deposit. This material will be carefully examined, and you will be duly notified of the results. It is suggested that you concentrate the gravel as well as you can before mailing it, care being taken not to lose any heavy material. You should carefully note on the package, or in a letter accompanying it, or both, the total quantity of original gravel which your concentrate represents, in order that a general idea may be obtained of the value of your gravel for the purposes under investigation.

"After an examination of these preliminary samples, experts will be sent to all localities where preliminary tests give promise of any useful mineral in profitable quantity. The expert will report on the size of the deposit and superintend the collection of representative samples for concentration.

"Concentration experiments will probably be carried out in connection with the exhibits of mining machinery at the Lewis and Clark Centennial at Portland, Oreg., between June 1 and October 15 of this year.

"I shall appreciate all information which you can give as to any efforts previously made to separate platinum from your sand, or from other sands in your neighborhood, and as to the quantity of platinum produced in your district. Each package of sand should be accompanied by exact information as to the name and post-office address of the sender, the name of the mine or claim from which it came, and the State, county, city, village, or district in which the deposit is located.

"On account of the increased demand for platinum, it is the intention of this office to examine also the localities where experience has made it probable that platinum ores may profitably be looked for in place. The inclosed tags can therefore be used also for sending in specimens of ores likely to contain platinum and associated metals.

"Great care should be used to pack the sand securely for transmission through the mails. It is preferable to sew up the sandtightly in a canvas bag and tie the tag, which requires no postage, carefully to the package. The sand should be dry when mailed.

"On request, additional postal franks will be sent to you.

"No specimens will be examined unless the above information in regard to the exact locality from which the samples have been obtained.

"The accompanying information in regard to platinum may be of interest to prospectors:

PROPERTIES OF PLATINUM.

"Pure platinum is a silvery white metal with a specific gravity of 21.5. It is the heaviest metal occurring in nature with the exception of iridosmium. It is almost as hard as iron and very malleable. Platinum does not amalgamate with quicksilver, is not dissolved by potassium cyanide when cold, and is not attacked by acids, except the mixture of nitric acid and hydrochloric acid known as aqua regia It is more difficult to melt than gold.

"Native platinum has been found most frequently in gold-bearing sands. On account of its weight it remains in the sluices with gold and other heavy material.

"Platinum is most readily distinguished as follows: (1) By its great weight—in panning it remains behind even gold in the pan; (2) its white color—it is whiter than lead and is distinguished from amalgam by its smooth surface, whereas the surface of amalgam, as seen under a good glass, is rough; (3) its resistance to nitric acid, as compared with native silver or lead.

"Native platinum is usually very impure; occasionally it contains so much iron, chromite, and other impurities as to be dark in color and not easily distinguished from grains of chromite with which it is very frequently associated. It often contains iridosmine, which occurs as flat angular scales, while platinum grains are usually rounded like gold dust. Generally, platinum grains are smaller than gold grains. Large nuggets are very rare."

In response to the request 828 samples of black sand were sent in for investigation, up to the time the report we are quoting from was issued. These samples came from 32 states and territories, as well as from Central America, Cuba and British Columbia. The responses showed that there has been more interest taken in these matters than has been heretofore supposed.

Of the samples received 195 specimens were assayed for their gold and platinum contents. The value in gold ran from a trace to 191.60 ounces in gold, and the values in platinum from a trace to 128.73 ounces per ton. One hundred and ninety of these samples were also examined for the minerals that they contained in addition to gold platinum: columbite, tantalite, magnetite, ilmenite, epidote, zircon, topaz, scheelite, hematite, pyrite, garnet, diorite, tourmaline, manazite, apatite, molybdenite, cinnabar, copper, actinolite, biotite, tremolite, psilomelane, rutile and polycrase. During June and July of last year investigations of various placer deposits were carried on. A preliminary examination of the heavy sands at the mouth of the Columbia River and from the Washington shore line was made by Dr. Day. He also examined the sands pumped up from the bottom of the Columbia River at Pillar Rock by the United States engineer. All these were sent to a concentrating pavillion, that had been built at Portland, where the practical tests were to be carried out. In addition to these sands he examined numerous samples from placer mines on the Pacific slope, as well as other beach sands from as far south as Sandiago.

RESULTS.

The following results have been obtained by concentrating the black sand:

Forty pounds of black sand received from Placer, Josephine County, Oreg., yielded oversize on 10-mesh screen, 18 pounds, 9 ounces, which yielded 13.754 grams of gold nuggets. The undersize, through a 10-mesh screen, weighing 21 pounds,5 ounces, yielded 11.6 grams of nugget gold. The total weight, 25.354 grams, would be worth, if pure, $16.84, giving a value per ton of $842.

Another interesting run of the black sands was from the residue from a clean up of dredging operations from Rockpoint, Oreg., which weighed 468.6 pounds, and contained quicksilver, amalgam, and gold. The oversize, through 10-mesh screen, was 223½ pounds and yielded 3.992 grams of gold; the undersize was 243 pounds and gave 15.270 grams of gold, making a total yield of nugget gold of 19 262 grams. This, if pure, would be worth $12 71, or the residues were worth $54.20 per ton.

Sea sand taken from near Fort Stevens, Oreg., at the mouth of the Columbia River, yielded the following results in pounds per ton of 2,000 pounds, on one of the concentrating tables, supplemented by the magnetic machine and by panning the samples:

[Pounds per short ton.]

Mineral obtained.	In the lot fed.	In the No. 1. concentrate	In the No. 2 concentrate	In the tailings.
Magnetite	683 0	572 0	44 6	66 79
Chromite and ilmenite *a*.	163 0	150 0	9 44	3 06
Garnet.	227 0	61 5	29 6	135 5
Monazite	$5	36	42	.07
Zircon	5.32	4.91	.01	0.40
Quartz	288.0	.97	2.86	284.3
Other minerals *b*	483.0	5.71	5.71	471.7
Gold and platinum *c*	.....	.....	.....	.....

a This product may prove by analysis to be mainly ilmenite.

b This product includes all the minerals that could not be separated into distinct groups.

c A satisfactory figure for publication has not yet been obtained.

THE MAGIC LURE.

For generations the great hinterland, back of the St. Lawrence, has lain fallow. With so much agricultural land to choose from it was quite natural that the young men of the Dominion should stake out for themselves farms in more genial and accessible regions. Yet, we must not forget that competent observers have found a large amount of excellent land in Northern Ontario, and a certain quantity of it in Northern Quebec, and it is more than probable that the recent rich finds of mineral in Cobalt, Chibogamoo, and elsewhere, will result in increased attention to these northern lands; and we know that history repeats itself. In 1851, after 63 years of colonization, the population of Australia was 403,000. In '51 gold was discovered. The whole face of Australia became changed, and in ten years the population had grown to 1,154,000. Similar effects were witnessed in California, in fact, have been noted wherever valuable mineral discoveries have been made. We may look forward with some confidence to a large increase of population in Northern Quebec and Ontario, and such increase will, it seems probable, occur within the next five years.

GERMANS USE MORE COPPER.

The following are the figures of the German consumption of foreign copper during January 1906, as compared with the corresponding period of 1905:—

	1906	1905
Imports	10,333 tons.	7,500 tons.
Exports	1,099 tons.	926 tons.
Consumption	9,234 tons.	6,574 tons.

Out of the above, 7586 tons were imported from the United States.

MINING IN BRITISH COLUMBIA.

The Annual Report of the Minister of Mines of the Province of British Columbia, for the year ending December 31st 1905, has been issued. As usual, this report is a model that could be followed with advantage by some of the other provinces. There can be no possible harm in making a report attractive, in fact we are inclined to think it wise so to do, and the British Columbia report is always a work that is not only attractive to the mining man, but of considerable interest to the laity as well. It is embellished with several pleasing reproductions, in colours, of British Columbia scenery, and though these cannot be considered as strictly germane to the subject of the publication, we think that it was wise to include them. They are, certainly, a means of advertising far and wide the beauties of Canada's most beautiful province.

The Provincial Mineralogist, Mr. William Fleet Robertson, in his report to the Minister of Mines states:

"The gross value of the mineral production of the Province during the year 1905 was $22,461,325, the largest output ever made by the mines of the Province, and an increase over the preceding year of $3,483,966, or 18.4%, while it is an increase over the year 1903 of over 28%. An analysis of the returns shows, however, that this increase has been confined to certain districts, South-East Kootenay, the boundary District, Nelson Mining Division, and Yale Mining Division, the remaining districts showing a more or less marked decrease. The greater part of the increase is in the two former of these districts. In South-East Kootenay the tonnage of ore mined increased 121% and the value of the product 135% over the preceding year, while in the Boundary the tonnage has increased 20% and the value of the output 53.6%.

The Slocan District shows the most marked decrease this year, its output being little better than half of what it was in the preceding year.

The Rossland camp just about held its own this past year. The tonnage of ore mined increased about 5%, but the values per ton diminished somewhat on the average, owing to the working of low grade ores by concentration methods.

The tonnage of ore mined in the whole Province, exclusive of coal, was this past year 1,706,679 tons, some 245,070 tons, or 16% greater than in 1904, and 85% greater than was mined 1901.

The number of mines from which shipments of ore were made in 1905 was 146, and of these only 79 properties shipped over 100 tons during the year, practically no change from the preceding year. Some 38 mines each shipped in excess of 1,000 tons, of which seven were in the Nelson Division, four in the Slocan, seven in Trail (Rossland,) and eleven in the Boundary.

The following table shows the number of metalliferous mines which shipped ore during the past year, together with the location of these mines and the number of men employed both above and below ground:—

remedying by bringing in water from another water-shed to supplement the present supply, at the expenditure of a large amount of money.

In the Fraser River District the dry season did not have so much effect, but individual mining on the bars appears to have been replaced by dredging, and the dredges have not met the expectation of the operators, for the reason, it is claimed, that the dredges have proved to be of too weak construction, and were so constantly under repair as to reduce the actual working time below the margin of profit. Steam shovels have not, as yet, been fully proven, and the one formerly operated in South East Kootenay has been, at least temporarily ,abandoned. The Atlin shovel apparently worked very well, but the appliances for handling the tailings and for washing the gravel proved quite inadequate, so much so that the capacity

TABLE SHOWING DISTRIBUTION OF SHIPPING MINES IN 1905.

	Tons of ore shipped	No. of mines shipping	No. of mines shipping over 100 tons in 1905	Men employed in these mines		
				Below	Above	Total
Cassiar:						
Skeena	143	2	1	S	11	19
East Kootenay:						
Fort Steele	170,073	3	3	250	67	317
Windmere	226	6	0	31	13	44
West Kootenay:						
Ainsworth	3,331	13	7	67	39	106
Nelson	50,090	21	15	250	14	392
Slocan	SS,279	52	20	352	16	457
Trail	330,61S	S	8	5S2	251	S33
Other Divisions	22,302	S	3	S9	26	115
Lillooet	133	1	1	2	2	4
Yale:						
Boundary	965,628	20	16	595	421	1,016
Ashcroft-Kamloops	14,642	3	1	52	25	77
Similkameen-Vernon	SS	1	0	7	7	14
Coast	61,126	S	4	109	93	202
Total	1,706,679	146	79	2,394	1,202	3,596

The collieries actually producing coal in the Province during 1905 were the same as in previous years, and are situated either on the Eastern side of Vancouver Island or on the Western slope of the Rockies, near the Crow's Nest Pass in the southeastern portion of British Columbia. The Vancouver Island collieries are operated by two companies, the Western Fuel Company, at Nanaimo, and the Wellington Colliery, at Ladysmith, Comox, while the collieries in Southeast Kootenay, at present some three in number, at Michel, Fernie and Carbonado, are all owned and operated by the same company—the Crow's Nest Pass Coal Company. The gross output of the coal mines for the year was 1,825,832 tons (2240 lbs.), which, with 314 tons taken from stock, makes a total production of 1,826,146 tons. Of this total amount 1,202,971 tons were sold as coal, 441,520 tons were used in making coke, and 181,655 tons were consumed under the company's boilers and sold locally. The coke produced amounted to 271,785 tons, of which some 268,091 tons were sold and 3,694 tons were added to stock.

The production of placer gold during the year amounted to $969,300.00, a decrease of $146,000.00, or 13% as compared with that of 1904, and is therefore the smallest output made in any year since 1901. This falling off is attributable to a very dry summer, preceded by a winter with little snow, with a resulting decreased supply of water for hydraulicing, in which class of mining the output seems to be in direct proportion to the water available for use, since the deposits of gravel appear to be fairly regular in their tenure of gold, and the output is measured by the amount of gravel washed. In the Atlin District the output of this past year was about $475,000.00, considerably less than in 1904, but still in excess of any year previous to that. In this district the drought was not so severely felt, as about 40% of the gold is mined by "individual" methods, in which case a large amount of water is not necessary. In the Dease Lake section of Cassiar mining is carried on largely by hydraulic methods, and between the dryness of the weather and the obstacles presented in getting plant in over a long pack trail, the season was not successful. The Cariboo mining division of the Cariboo District about held its own, but the production of the Quesnel Division was some 40% less, owing to the very short run made by the largest producing property. The Consolidated Cariboo, due to an unprecedentedly low water supply, a trouble which the company has set about of the shovel was never fully demonstrated. Enough was learned, however, to indicate that, for conditions in the North, the steam shovel is likely to prove much more effective than the dredge.

The value of the output of gold in British Columbia from lode mining for the year 1905 was $493,102.00, an increase over the preceding year of some $343,494.00, or about 74%, due entirely to the increased tonnage of gold-bearing copper ores smelted in the Boundary District. The greater part of the lode gold produced is found in combination with copper; in fact only 11% of the total gold is produced from stamp mills, and even in these mills about half of the values are obtained in concentrates, which are afterwards smelted.

About 70% of the silver produced in the Province was associated with lead and argentiferous galena, the remainder being found chiefly in conjunction with copper ores. The total production was 3,439,417 ounces, valued at $1,971,818.00, the largest output the Province has made since 1901, despite the fact of a decrease in the Slocan of 494,000 ounces. The increase is due, primarily, to the extensive working this year of the galenas, low grade in silver of the Fort Steele District, which district shows an increased production of nearly 550,000 ounces; and, consequently, in the increased tonnage of the large copper mines in the Boundary, and the working of certain smaller but high grade properties in that district, resulting in an increased silver production in the Boundary of about 385,000 ounces.

(To be Continued.)

MINING IN QUEBEC.

The report of the Department of Colonization of Mines and Fisheries of the Province of Quebec, for the year 1905, has just been issued. Mr. J. Obalski, Superintendent of Mines, states that the production exceeded that of 1904 by about one million dollars. The discoveries at Chibogamoo and Cobalt have greatly encouraged prospectors, and numerous applications for prospecting licenses in the Northern districts of the Province between Lake Temiskaming and Lake Mistassini are being received.

Mr. Obalski spent some time at the Liège Exhibition as commissioner for the Dominion Government, and was active in making Canada's mineral wealth known in Europe.

IRON.

There has been no development in our iron mines with the exception of prospects and experiments in connection with the magnetic sands of the north shore of the St. Lawrence. It may, however, be stated that, according to borings beneath low-tide level, those sand deposits extend in certain cases some distance out and could be dredged where the water is shallow.

Experiments in the treatment of iron ores in electric furnaces are being continued at Sault Ste. Marie under the patronage of the Federal Government but we must await a final report to know whether that process has really any commercial value.

COPPER.

The Nichols and Eustis Companies continued to work regularly. The latter put up concentration works to utilize the large quantity of debris that had accumulated for some years.

The Ascot Mine was lightly worked, producing a small quantity of good grade ore, which was treated at Capelton. The King Mine on lot 4, II Ascot, was sunk deeper, a few men being employed throughout the year, but no ore was shipped.

This year's yield for the whole region was 25,575 long tons, of the value of $128,850, 14,172 tons of which were shipped to the United States, and the remainder treated for sulphur and copper by the Nichols Chemical Company at Capelton; 245 men were employed during the greater portion of the year.

ASBESTOS.

The asbestos industry has continued to develop with the greatest success, and this year the production was 25 per cent. greater than last year while the prices have kept up. The new uses made of asbestos pulp are very encouraging and most remarkable imitations of wood are now seen which seem likely to have a good future. The result of the progress has been the opening of new mines, which, until the present, have been considered as under less favorable conditions than the mines formerly worked. At Thetford, the Bell and King companies (the latter now being the American Asbestos Company), and the Johnston Company worked both mines and mills throughout the year with the greatest activity and the maximum of production.

It is proposed to introduce electricity as motive power in the mines and mills, the St. Francis Water-Power Company being prepared to supply it.

Discoveries made last year at Chibogamoo have been confirmed, but that region cannot put its productions on the market until a railway is built. Activity in the asbestos industry has also called attention to indications found in Gaspesia and in the Temiskaming region, but nothing has yet been done there.

The production of asbestos during the year 1905, in tons of 2000 lbs. was:

1st. class crude	1340 tons	worth	$221,325
2nd " "	2258 "	"	243,785
Fibre	10707 "	"	386,440
Paper stock	34655 "	"	624,900
Total	48960 "	"	$1,476,450
Asbestic	19220 "	"	31,100

One thousand six hundred and fifty workmen, receiving $580,000.00 in wages, were employed during periods of from seven to twelve months. Seven companies produced regularly and actively, two of them working mines and mills at Thetford and Black Lake at the same time.

The production for last year (1904), not including asbestic, was 35,479 tons worth $1,186,795, thus making an increase of 25 per cent for this year as already stated.

MICA.

Mining for amber mica was continued in the county of Ottawa, there being no change in the number of companies shipping.

The market for amber mica is fairly good, especially for small dimensions, and Ottawa continues to be the centre of preparation for mica from the Ontario and Quebec mines. The mining companies themselves prepare the mica from their mines at Ottawa and Hull, but the following companies must also be mentioned: The General Electric Company, the Laurentides Mica Company, E. Munsell and others of less importance, which have thoroughly fitted up works where the mica is trimmed and split or even cut in special shapes for shipment to the United States where it is transformed into micanite or other commercial products. The works are provided with knives and tools, driven by steam or electricity, and women are employed, as their labor is most suitable for such delicate work. This industry gives employment to 600 women and girls at Hull and at Ottawa; they are under the supervision of forewomen and work by piece-work, earning very fair wages.

A noteworthy fact is that mica is beginning to be shipped regularly to Europe and our amber mica is highly appreciated owing to its flexibility and its being easy to split.

While I was at the Liége Exhibition, we received many applications which were referred to the Canadian producers, and I think that, when an understanding shall have been come to with reference to the merchantable form of that mica, a good market will be found for it in Europe. It is true, on the other hand, that we have to compete with the Indian mica which can be delivered at a very low price owing to the cheapness of labor in that country, and it is a noteworthy fact that the companies mentioned above, which prepare mica at Ottawa, receive large quantities of Indian mica of small dimensions, very well prepared, which is split and mixed with Canadian mica for the manufacture of micanite. Those companies assert that it does not cost them more, delivered in Ottawa, than the mica of our own country.

The production in 1905, representing the quantities shipped, is as follows:

1	65666 lbs.	worth	$ 3852
2	159562 "	"	22316
3	63206 "	"	23165
2-4	45170 "	"	21730
3-5	16332 "	"	11012
4-6	6338 "	"	6190
5-8	857 "	"	786
Total thumb-trimmed	357160 "	"	$89060
Split	21400 "	"	6400
Total	378560 "	"	$95460

WHITE MICA AND RARE EARTHS.

Several mines of white mica (muscovite) are likely to be worked after having been abandoned for several years. As it has been found that this white mica carries Uranium, Thorium, Yttrium, Cerium, and also, in some cases, Radium. A French Company proposes to work the Maisonneuve mine, in the County of Charlevoix, for these rare minerals. Last season several tons were sent from this mine to Paris, to be assayed, and the results were evidently satisfactory.

PHOSPHATE.

Very little phosphate was mined last year, the total reaching but 1,475 tons, valued at $18,875.00. This phosphate came from Ottawa, and partly from mica mines, though a little was got from old phosphate mines.

BUILDING MATERIALS.

The International Portland Cement Company, Ltd., of Hull, and Mr. T. M. Morgan's plant at Longue Pointe, Montreal, produced altogether 254,833 barrels worth $408,000.00. It is anticipated that this industry will increase very rapidly. The following summary shows the total wealth of the mines in the Province of Quebec for the year 1905:

Kind of Minerals (Tons of 2,000 lbs.)	Wages paid.	Number of workmen.	Quantities shipped or used.	Gross value.
Bog iron ore	$ 22,000	120	12,373	$ 35,268
Chromic iron	52,000	125	8,528	104,565
Copper ore	90,928	245	28,644	128,850
Asbestos	576,700	1,650	48,960	1,476,450
Asbestic	.....	.....	19,220	31,100
Mica (pounds)	45,000	180	378,560	95,460
Calcined ochre	11,035	56	1,905	22,675
Phosphate	.....	.....	1,475	8,875
Slates (squares)	15,000	45	4,900	21,568
Flag-stones(sq.yds)	1,700	6	2,930	2,490
Cement (barrels)	150,000	160	254,833	408,000
Granite	70,000	180	.....	120,000
Lime (bushels)	.....	350	1 million.	140,000
Bricks	600,000	1,200	120 "	625,000
Stone	.....	700	.....	530,000
Totals	$1,631,363	5,017	.....	$3,750,300

PERSONALS.

Mr. T. Hayes Sheen, a director of the Copper Mining & Smelting Company of Ontario, is visiting the Bruce mines.

Mr. A. R. Wilson, superintendent of the colliery at Michel, Crow's Nest, has gone to his ranch in the Okanagon for a holiday.

Mr. A. G. Browning, Crown Attorney of North Bay, has been in Cobalt looking after some cases he has on hand pertaining to the stealing of ore from the mines.

Mr. Cecil B. Smith, chairman of the Temiskaming & Northern Railway Commission, visited Cobalt a few days ago in order to ascertain the needs of the place.

Mr. J. B. Tyrrell, C.E. and M.E., has been engaged as mining expert by Mackenzie & Mann, of the Canadian Northern Railway, and will have his headquarters in Toronto.

Superintendent A. B. W. Hodges, of the Granby mines and smelter, has been visiting the Crow's Nest Pass and making a careful investigation of the various coking coals of that region.

Mr. J. H. Black, Superintendent of the Temiskaming & Northern Ontario Railway, was in Cobalt recently looking over the place and making final arrangements for the sale of town lots.

Mr. Arthur Harris, mining engineer of London, England, has arrived in Cobalt and will make a thorough examination of the mining section of the district and report to the members of the syndicate which he represents.

Mr. W. F. Ferrier, formerly geologist for the War Eagle and Centre Star mines, but now a resident of San Francisco, has been heard from. He went through the disaster safely. Mrs. Ferrier and her two children are in Toronto.

Mr. M. M. Johnson, Consulting Engineer of the Dominion Copper Company, has returned to his home at Salt Lake City, Utah, after a visit to Phœnix, where he has been consulting with Mr. Thos. R. Drummond, Manager for the Dominion Copper Company.

Mr. Fuller C. Smith, chairman of the Vermont State railway commission, of St. Albans, Vt., and Colonel H. S. Bingham, one of the commissioners and secretary of the commission, of Bennington, Vt., were in Rossland recently, and visited the workings of the Le Roi.

Mr. F. A. Paulin, late Chicago Manager, for the India Rubber Company of New Brunswick, N.J., is now in charge of the Tire Department of The Canadian Rubber Co. of Montreal, Limited. Mr. Paulin is a Canadian by birth, having spent his early years in the Carriage Trade in Ontario. He has had extended experience during the past twelve years throughout the larger cities in the United States.

Mr. Richard Russell, of Hamilton, Ont., was in Penticton recently attending the meeting of the Southern Okanagan Land Company. Mr. Russell is one of the heavy stockholders in the once famous Stemwinder, Fairview. He states that, after having spent one million dollars, capital is again available, and another half million will be spent in further work upon the Stemwinder.

Mr. K. Nakamura, chief metallurgist of the Besshi Copper mine, Island of Shikoku, southwest of Kobe, Japan, has been visiting the Granby, Nelson, and Hall Mine Smelters. He is now in the United States, and later on will go to Mexico and Europe. He will probably visit South Africa and Australia before returning to his country. He is one of the most eminent of Japan's metallurgists.

Mr. Jacob Langeloth, of New York, the president of the Granby Consolidated, has been visiting Phœnix on his annual trip of inspection. Mr. Frederick Keffer, M.E., chief engineer of the British Columbia Copper Company, accompanied by Mr. Johnson, formerly superintendent of the Emma mine, who has been examining the Gloucester group, recently acquired by the B.C. Copper Company.

Mr. A. L. Mudge, who has been appointed Estimating Engineer of Allis-Chalmers-Bullock, Limited, Montreal, is one more Canadian who after experience in the great industrial establishments of the United States, has returned to take a responsible position at home.

After graduating from McGill University in Mechanical Engineering in 1894, and in Electrical Engineering in 1895, he spent one and one-half years with the Canadian General Electric Co., Peterboro, and afterwards some time with the Royal Electric Co., Montreal. From 1899 to 1901 he was Electrical Engineer for the Grand Trunk Railway System from Portland to Detroit. From Montreal he went to Pittsfield, Mass., to take charge of construction work for the Stanley Electric Manufacturing Co. During the past two years he has been with the Allis-Chalmers Co. partly in the Bullock Electric Works, Cincinnati, and latterly in the Head Office, Milwaukee.

MINING NOTES.

BRITISH COLUMBIA.

The St. Eugene's output for the month of April was 2,860 tons.

The Bottom Dollar and Nancy Hanks are said to be showing up well in development.

The Velvet Portland mine, after having been shut down for more than a year, is to be opened again. Mr. Paul S. Couldrey, manager of the Le Roi No. 2, will be in charge.

The Canadian Pacific is building a new depot at Fernie, together with freight buildings. Work will be completed as rapidly as possible.

Ore has been found on the Jumbo, 150 feet from the Old Glory hole. The new find is on the foot instead of the hanging wall. The ledge at this point is about 300 feet wide.

A winze is being sunk from the fifth level of the Ottawa. A new hoist and 10-drill plant of the Lidgerwood make is being installed.

The Consolidated Mining and Smelting Company of Canada has just secured a controlling interest in the Eureka Copper Mines on Forty-Nine Creek.

The Telkwa Mining, Milling & Development Company owning extensive properties near the headquarters of the Telkwa and Copper Rivers, has sent up a number of men to the Bulkley Valley, in charge of Mr. Harry Howson, general manager.

The Ore Hill mine at Salmo has ordered from Chicago a three rapid-stamp outfit, and this, with what mill machinery they now have will give them a five-stamp equipment. They are also erecting a 750-foot tram from the mine to the mill.

The returns for the Tyee smelter at Ladysmith for the month of April show that the smelter ran 13 days and treated 1,717 tons of Tyee ore, giving a return, after deduction of freight and refining charges, of $34,723.

Wilson Creek, a tributary of O'Donnell River, is the scene of the most recent stampede. Pay has been found in hard pan two feet below the surface. The new discovery is about 26 miles from Atlin. For several miles on the south side of Discovery, the creek bottom is from one to two hundred feet wide, but with little grade. There is said to be ample water.

A discovery of free gold is said to have been made on Woodbury Creek, near Nelson, B.C. The finders have blanketed the country with claims, recorded at the Ainsworth office. It is claimed the discoveries are equal to anything ever found on Poplar Creek. Woodbury Creek is situated on Kootenay Lake, discharging into it north of Proctor and south of Kaslo.

Operations on the development of the Bog iron ore properties, on the southwest arm of Quatsimo, V.I., are vigorously being carried out. The ore is looking better all the time. The management has just decided to supplant all its Chinese hands with white labor, a move which will be greatly appreciated by the settlers in that locality.

The Ymir Gold Mines, Limited, having followed a policy of development since last fall, will shortly resume operations on a larger scale. The development work that has been done has proved conclusively that the contention of manager E. M. Hand, supported by Mr. Gilman Brown, the company's consulting engineer, was absolutely correct. Mr. Hand came to the conclusion shortly after he took control that the future of the mine depended upon the western half. In working there he found a large ore body at depth. That ore body has now been well opened up and shows good values and great extent from the 700 foot to the 1000 foot level.

The larger mines of the camp, the Centre Star, War Eagle, Le Roi and Le Roi No. 2, have been very successful in locating the ore bodies by means of diamond drills, indeed, it is now considered a necessary part of the equipment of each of these mines to have diamond drills which are kept in constant operation. It is found to be the most economical method of prospecting. Encouraged by the success of the diamond drills in the larger mines, they are now being adopted in the smaller. The Jumbo and White Bear are now arranging for some extended experimental work with the diamond drills. In the latter operations will be commenced with the drills on Monday and in the former in a few days.

Boundary District.

Two diamond drills are again being operated at the Granby mines.

Some Providence ore is being sent to the Hall Mines smelter at Nelson.

A diamond drill is being operated at the McKinley mine, McKinley camp.

A glory hole is being opened up on the Stemwinder, and the Idaho is likely to have another.

A 12-inch gold and silver vein has been opened up on the Starve Out claim, near the Helen, by Hostetter and Peone.

Smith & Co., of Grand Forks, are reported to have taken up the bond acquired by them on the M. S. group in Franklin camp.

In sinking to the 300-foot level of the Elkhorn, about eight inches of excellent silver ore were found a few days since at a depth of 260 feet in the shaft.

A cross-cut is being run from the 100-foot level on the Washington and Idaho, West Fork, where Mike Callaghan has half a dozen men at work for Collins Hunter and others.

Development work is to be resumed on the Bay mine in Skylark camp, which has produced such high values in gold in the past. The boiler is being repaired, and active work will be taken up again.

From the last car of Rambler ore net returns of $111 per ton were received, the property being located up the West Fork. It is reported that the owners refused a bond of $50,000 on the Rambler quite recently.

Pay day in the Boundary camps means the disbursing of $125,000.00. This does not include the pay roll for the work being done on new construction. The different companies paid out in April as follows:—Granby, $75,000.00; B. C. Copper Company, $26,000.00; Dominion Copper Company, $25,000.00.

The Rathmullen mines, in Summit camp, are steadily progressing and will have one of their group a shipper shortly. Considerable development work has been done the past two years on the crown granted claims of the company, but latterly work has been confined to the Reliance claim, which has been developed by a 100-foot shaft and drifts at the 50-foot and lower levels. The face of the drift at the 100-foot level is well in ore.

The four-compartment shaft at the Mother Lode mine is nearing the 400-foot level. Drifting to connect with the winze from the north drift, which reached the 400-foot level some time ago, will be done as soon as possible after the shaft reaches the 400. The Mother Lode diamond drill has been in operation on Primrose ground (to the south of the main shaft), where a hole 200 feet deep has been drilled, showing considerable ore.

Mr. M. M. Johnson, consulting engineer to the Dominion Copper Company, with Mr. Thos. R. Drummond, manager, inspected the Sunset group, in Deadwood Camp, the Mountain Rose in Summit, and the Brooklyn Stemwinder, Idaho, and Rawhide mines in Phœnix Camp. He also visited the company's reduction works at Boundary Falls. In the course of the present month active work will be under way on some of the improvements, which include preparations for doubling the smelting capacity to 1,200 tons daily and the installation of a new 25-drill electric-drive air compressor at the Idaho mine in Phœnix camp. Some time in early fall, if machinery contracts are lived up to, these improvements should be completed, and in the meantime the mines of the company are being placed in a position to furnish the increased output needed to keep the enlarged smelter busy. At mines and smelter the company is now employing 300 men, and the smelter is turning out about a carload of copper matte every other day.

The Canadian Rand Drill Co., of Sherbrooke, Que., has received an order for an electric air-compressing plant for the Brooklyn group in Phœnix Camp, B. C. It will be of the double compound tandem type, similar to that in use at the Granby mines, but smaller, having a rated capacity of about 25 machine drills. This compressor will be capable of furnishing 2,726 cubic feet of free air per minute at sea level, or about 2,300 feet at the level of Phœnix. Delivery of the new plant has been contracted for in sixty days' time.

The contract for the 400 h.p. electric motor, to drive the new compressor has not yet been awarded, but probably will be within the next few days.

For a hoist for the three-compartment shaft being sunk on the Idaho mine, the steam driven hoist now in use by the company at the Sunset mine, Deadwood camp, will be altered for electric service and transferred to this camp. This is a large machine and suitable for the work intended. A contract for the 150 h.p. electric motor, to drive this hoist, has been awarded to the Allis-Chalmers-Bullock, Ltd., of Montreal, and will be rated at 550 volts. The motors will have full equipment of transformers, etc.

This machinery is all intended for a centrally located plant, to serve the Brooklyn, Stemwinder and Idaho mines in the heart of this camp, and as soon as needed, work will be started on the large buildings needed to house the new machinery.

YUKON.

A nugget, weighing 9¼ ounces, has been taken out of No. 21 Below, on Sulphur Creek, Klondike. The shaft had been abandoned, yet this is the largest nugget ever taken out of the creek.

An important feature on the Yukon this summer will be the active development of the coal mines at Tantalus, midway between Whitehorse and Dawson, says a recent number of the *Vancouver World*. The mine was recently purchased by the White Pass & Yukon Route Co.

It is said Dr. David Y. Day of the U.S. Geological Survey has found sufficient platinum in sand from the Hootalinqua to make it worth while dredging that stream. A Portland company has been formed to work the leases acquired by the Rev. Mr. Vrooman of that city.

A quest for gold in Terra del Fuego, south of Patagonia, is the object of an expedition which will shortly start from Great Britain.

Prospectors discovered alluvial gold as far back as 1880, and the purpose of the present expedition is to dredge for gold, in that country.

A stern-wheel boat has been constructed in Thornycroft's yard at Chiswick on the Thames, for the use of the expedition.

"Mine and Quarry" is the name of a quarterly bulletin issued by the Sullivan Machinery Company. Its object is to familiarize its readers with the different classes of machinery manufactured by the Sullivan Machinery Company. It is published at the Railway Exchange Building, Chicago. The initial number contains a very interesting paper on the cleaving of granite by compressed air, together with several other articles that will prove of interest to mining engineers and others whose work is connected with the mining industry.

The Ballarat Company, organized under an Ontario charter, is to dredge the Fortymile this summer. The original ground secured by the Company was that known as the Rutledge concession, but later all the interests from the mouth of the Fortymile to the international boundary were consolidated, and a Dominion charter obtained. There is another dredging company on the American side which is often confused in reports with that controlled by the Davidson Brothers and the Rev. Dr. Grant, who are the largest shareholders in the Ballarat. The dredge recently bought from the Treadgold people was sledded over the ice for use on the American side from Bonanza to Fortymile.

QUEBEC.

The Diamond Graphite Co., of New York commenced the erection on Mr. James Cosgrove's property at Buckingham, P.Q., of a hundred ton ore treating plant with offices, boarding houses and other accessories of a large centre of mining and milling operations. Mr. Geo. N. Brewer, the energetic manager of this company, now that arrangements have been completed for the transfer of many valuable properties to his company has a gang of men at work in building operations according to plans prepared by himself during negotiations between the Diamond Graphite Co., and some residents by the satisfactory conclusion of which the company acquired sufficient ore bearing

ground to run the proposed plant indefinitely. Work on the plant will be pushed as strongly as possible. Between thirty and fifty men are employed and this number will be increased very soon It is proposed to run the plant by electricity, but whether it will be generated at the mine or brought from a distance has not been decided yet.

ONTARIO.

The International Nickel Co. has sent an expert to report on the mineral lands of the Anglo-American Co. in Eastern Ontario.

Machinery for dressing has been installed at the sodalite mine near Bancroft. The demand for this stone for decorative purposes is growing as it becomes better known.

Hon. F. Cochrane has not yet given his decision in the dispute as to the ownership of the Josephine iron mine as it is hoped the parties concerned may be able to arrive at a settlement.

A valuable find of bog iron ore is reported from the township of Oakley, Muskoka. The ore is said to be almost entirely free from sulphur. It has been tested at a Bracebridge foundry and gives every satisfaction.

A quartz reef has been discovered on the farm of David Todd, three miles from the Oso railway station. The reef is three feet six inches in width, and assaying one ounce of gold per ton. Developing work is to be proceeded with.

A smelter plant has been set up at the El Dorado copper mine in Hastings and will be in operation in June. A stamp mill and tubular boiler have been ordered. Recent tests with the diamond drill show satisfactory results.

A suit for $5000 damages has been brought by the Dominion Improvement & Development Co., of Westport, Leeds Co., against John Blackhall of Lanark Co. and Chas. E. Eisner, of New York, for trespass on a mica mine which the plaintiffs' claim to own.

An order for 650 tons of talc from the Madoc Mine has been received from New York. A mill is to be installed to grind the mineral on the spot for the Canadian market. Hitherto it has gone to the United States to be ground and then returned to Canada.

Among the mining leases cancelled during the past month for non-payment of dues are a number in the older parts of Ontario, including Muskoka, Lennox and Addington, Hastings, Haliburton, Renfrew and Peterborough. Those cancelled hitherto were in New Ontario.

Prof. Geo. R. Mickle, lecturer on mining at the school of Practical Science, Toronto, who was one of the inspectors in the Cobalt district last year, has been appointed, under the Mines Act of last session, inspector of mining claims for the present season, and has entered upon his duties.

Some fine crystals of mica have been taken from the Smith mine, in Burgess, Ontario. One crystal sold for $30 00. One cut taken out of it measured 22 + 14 inches. About $200.00 worth of mica a day has been mined. The mine owned by William McLaren is turning out mica to the value of about $300.00 each month.

The Atlas Arsenic Co. is proposing to work the mispickel ore on the Gatling property in Marmora. This ore contains about 46 per cent of arsenic and at present prices should be worth working. It carries also about $7 a ton in gold. The deposits were worked at one time but have been closed for some years.

The introduction of natural gas at Hamilton, forming a strong competition to coal gas, has drawn attention to the fact that there is a Dominion statute prohibiting the use of gas containing carburetted hydrogen for lighting. The Minister of Inland Revenue has ordered an investigation, and tests will be made with a view of enforcing the law.

The name of the Department of Lands and Mines has been changed to Lands, Forests and Mines, of which Hon. F. Cochrane is Minister. Mr. Aubry White, formerly Deputy Minister of Lands and Mines, has been gazetted Deputy Minister of Lands and Forests. Mr. T. W. Gibson, formerly Director of the Bureau of Mines, has been gazetted Deputy Minister of Mines.

Promoters of mining companies would do well to remember that the act of last session of the Ontario legislature respecting prospectuses is now in force. It requires prospectuses of every company selling shares or debentures in Ontario, whether chartered under the laws of the province or otherwise, to be filed with the Provincial Secretary and to be given to every purchaser or intending purchaser. A penalty is attached to neglect of this requirement.

Dr. Haanel, Superintendent of Mines, has sent to the Governor-General a specimen of pig iron smelted by electric process during the recent experiments at Sault Ste. Marie. The pig iron has been beautifully ground and bevelled and enclosed on an ebonized frame. Its smooth and shining surface, which looks like steel, bears a suitable inscription in red letters. Samples of the pig iron in the form of paper weights with suitable inscriptions have been forwarded to the Prime Minister and Members of the Cabinet.

Regulations passed several years ago in Ontario with reference to corundum lands have been revoked, except in the case of special agreements with J. N. Shenstone and B. C. Craig in 1899 and 1890, with the Canada Corundum Co. in 1903, and with the Corundum Refiners, Limited, in 1901 and 1905. These agreements were made to encourage the establishment of corundum works at a time when the enterprise was in its initial stages. Henceforth corundum properties will be dealt with the same as other mining lands.

Part III of the Bureau of Mines Report for Ontario has just been issued. Its chief feature is Prof. Coleman's final report on the Sudbury Nickel fields, which he has been investigating for the past three seasons. In a chapter devoted to the uses of nickel, Prof. Coleman advocates a pure nickel coinage instead of the nickel-copper alloy now used in Canada. Switzerland, Austria-Hungary and France have adopted it. It has many advantages. There are two companies at work at present in the nickel field. The Canadian Copper Co. and the Mond.

Mr. H. Baker, of Berlin, Germany, who represents the Canada Corundum Co. in Germany and Russia, has been on a visit to Canada, and with Mr. Craig visited the mines and mill at Craigmont. The company is now turning out over 300 tons a month, and will increase that amount in the near future. At the time of writing a shipment of 200 tons is on its way to Berlin. A new deposit of corundum is being opened up, of a more gem like character, which it is considered will be better for certain purposes. There is a large hill, with millions of tons of this saphire like corundum in sight.

In addition to the mines act three measures relating to the mining industry were passed at the recent session of the Ontario Legislature. One was to amend the act to prevent the waste of natural gas and to provide for the plugging of all abandoned wells. This will have a tendency to prevent waste in our natural gas supply. Another relates to the town of Bruce Mines and the Copper Mining and Smelting Co. of Ontario and validates an agreement by which the town undertook to exempt the Copper Co. from taxation to an extent exceeding the powers conferred upon municipalities, under the general act. The third legalizes an agreement between the Company owing the Port-Arthur blast furnace for iron ore and the owners of the coal and ore dock at that town.

The bills to impose a tax on mineral lands, and to authorize a bonus to a smelter for Cobalt ores, were dropped at the late session of the Ontario legislature, there not being time to consider them fully, but it is probable they will come up again next session. The former meets with considerable opposition. A bonus will be given to a smelter, only if the money comes in some form from the mining industry, and not out of the general funds of the province. A free site has, however, been promised to the Silverland Development Co., which has secured the right to use the German Schneiberg process and a suitable place is being looked up on the line of the Temiskaming & Northern Ontario, where there is little timber or agricultural land, the fumes from the smelter being most destructive to

vegetable life. The smelter will cost about $600,000 and will be in charge of two German experts. Argentite Mining and Smelting Co., recently organized, to carry on Mining, also proposes to build a smelter if it can secure government assistance, and Mr. Norton, its manager from New York, has been in Toronto and North looking over the ground.

COBALT.

Silver and gold ores have, it is reported, been found in the township of McLillan, near Sudbury.

The De Forest Wireless Telegraph Co. propose to establish their system between Haileybury and Toronto.

What is described as a silver nugget, weighing 400 pounds, but which is really a mass of silver ore, was recently taken out of the 215 foot level of the Larose Mine.

The building of the T. and N. O. Railway has preserved the bulk of the trade of this great northern district for Toronto, which otherwise would have been diverted to Ottawa and Montreal.

The Abittibi region is full of great mineral possibilities like those which have rendered the Cobalt district famous. The latest reported discoveries made around Lake Abittibi are most promising.

Professor Miller, provincial geologist and party, will thoroughly explore the Gillies limit during the summer, and in the fall the government will begin mining operations.

The Caldwell-Mulock iron property at Temagami is to be worked this season under the direction of Prof. Wilmot. A number of copper properties on Lake Temagami are also being opened up.

The mining property owned by Shillington and Powell, of Ottawa has been sold for $40,000. They bought the claim last fall for $250 and during the winter spent a little money in development.

By an order in Council the township of Coleman, except Cobalt and Kerr lakes, has been set apart as a special mining division under the mines act of 1906, with G. T. Smith as Mining recorder, with office at Haileybury.

The cases of McLeod vs. Lawson and McLeod vs. Crawford, the facts of which were given in the April REVIEW, have gone to the Court of Appeal. Argument has been heard and judgment reserved.

A suit has been entered by E. Gauthier against E. Richards, of Cobalt, for the specific performance of an agreement for the sale and delivery of 500 shares in the Foster-Cobalt Mining Co., or damages to the amount of $1,000.

Dodge vs. Cobalt Merchants Mining Co. is an action arising from a dispute over mining claim No. 220 recorded in the Temiskaming Mining Division. The question is whether an agreement should be carried out, the time which was agreed upon having expired.

A suit has been entered by C. D. Scott against M. G. Hunt and the Red Rock Mining Co., to prevent Hunt from dealing with money or stock of the company, and the company from giving Hunt stock until a matter in dispute is settled. Thirty acres of mineral land is involved.

Machinery is being installed at the Columbus Mine near Cobalt. As the shaft went down the vein matter improved in a very marked way, but a considerable inflow of water was encountered, making necessary the installation of a pumping plant.

The explosion of seven and a half tons of dynamite at Cobalt has drawn attention to the danger of keeping such a large amount of explosives in one place. That such an explosion could take place and no one be seriously hurt is little short of miraculous.

The Montreal Cobalt Mining Company, who have a claim of 107 acres of mining lands on the Montreal River, adjacent to the Gillies limit, are making active preparations for development work. A diamond drill has been ordered and a large force of men will be employed.

The Cobalt Contact Silver Mines Co., Limited, has purchased the property of The Green Silver Mines Co., Limited. An order in Council has been passed authorizing a change of name from the latter to the former. New York capital is interested in the purchase. It is proposed to divide the property into single acre blocks and lease the alternate ones on working conditions, as is done in some of the western mining camps.

The statement which has appeared in some of the newspapers that the proceeds from the sale of mineral rights and percentage from minerals mined on the Cobalt town site and the right of way of the T. & N. O. Railway, are to be applied to an extension of the railway to James Bay, is unauthorized. The money will go into the general funds of the commission and may or may not be used for an extension.

The Cobalt Standard Mining Exchange is about to erect a building to cost $20,000, on a lot for which $15,000 cash was paid, or $215 a foot. Property on the Main Street of the northern silver town is soaring. Latchford, 8 miles south, at the crossing of the Montreal River, is also growing. In prospecting for gold north of the town a 12 inch vein of quartz carrying gold and copper was discovered. Cobalt-bloom and calcite were also found.

Considerable interest is taken in the system of hydraulic prospecting by washing the soil and moss off the rock by means of a powerful stream of water, instead of trenching, which has been in use hitherto at Cobalt. The water will have to be pumped, but even then it will be cheaper and more effective than trenching. A great deal of the prospecting done last year was very superficial and it is probable some rich veins have been passed over.

The terrific explosion of 7½ tons of dynamite at Cobalt, on May 18th., did very little damage as compared with what might have happened. A few panes of glass were broken, some shacks destroyed, and a number of persons received bruises, contusions, and suffered severe mental distress, as the court reporters say, but otherwise the explosion seemed to have done but little harm. About fifty houses in the French section were, however, burned when the fire that had been raging in the near-by woods spread to the town.

The question of the supply of pure drinking water is still the great and pressing need, though it is now about to be met as a firm of Ottawa contractors have secured the franchise for the new water and electric light service to be installed in the town, and in time extended to all the surrounding camps.

Construction work is to commence immediately, and water will be conveyed in pipes from Clear Lake. The franchise is to extend over a period of ten years. The water rates are to average $2.50 per quarter. Arc lights are to be $6 and $8 per annum. The contract price for the plant is $60.000.

A dispute has arisen between one Pettifer and one Sands over an iron property at Temagami. Sands was informed by a J. P. that if he wished to obtain the property he must have a survey made, and he ordered it to be done. Before it was made the statutory time had expired, Pettifer, who had been negotiating for its purchase, then applied for the property and complied with the conditions. The Minister of Lands and Mines has staged the lease to Pettifer pending an investigation and the matter will probably go before the courts. The point is whether the fact that Pettifer was dealing with Sands for purchase precludes him from getting a lease.

The silver property of W. R. Smyth, M.P.P., adjoining Clear Lake, immediately south-west of the town site of Cobalt has been sold to the Clear Lake Mining Co., which will proceed with development work at once. Mr. Smyth retains considerable stock in the company. The same company will work a vein of rich ore under Clear Lake, which has been discovered by means of the diamond drill.. They will immediately proceed to sink a shaft, the water being kept out by means of a crib. The property is owned by Messrs W. J. Gren, Hyland and others of Toronto and the diamond drill tests were made by Major Gordon. The Clear Lake Mining Company, which will work the two properties, will be capitalized at $650,000.

As was anticipated, a great deal of litigation has arisen in connection with Cobalt mining properties. One of the most important cases is that now being tried before Chancellor Sir John Boyd, without a jury, at the Toronto assizes. It is brought by the Attorney General of Ontario against Edward C. Hargrave, of Bay City, Mich., F. M. Rutherford, of Niagara Falls, C. G. Williams, of Montreal, and the White Silver Mining Co., of Toronto, to set aside the leases for 80 acres of mining lands which it is alleged were obtained by fraud. The claims were staked out by George Hanes, of Windsor, who swore that he discovered valuable mineral. Douglas C. Raymond, a student of the School of Practical Science, Toronto, had also applied for leases of some of the claims which Hanes staked out. A large number of witnesses are being examined, and the case is stub-

bornly fought. From the large interests involved and the valuable property at stake it is probable the case will go to the Privy Council before it is finally disposed of. There are a number of other similar cases.

The Temiskaming and Northern Ontario Railway commission, which recently called for tenders for mining concessions on the town site of Cobalt and on the right-of-way of the railway, has accepted the offer of the Cobalt Town Site Mining Co., a joint stock company made up of a consolidation of all the interests involved for the south-west 37 acres of the town site. The company pays a cash bonus of $35,000. For the north-west 40 acres negotiations are going on with one of the tenderers. For mining rights on the railway right-of-way nothing could be done in consequence of the action taken by the La Rose Mining Co., which applied for an injunction restraining the commission from disposing of or dealing in any way with the minerals on that portion of the right-of-way which runs through mining location J. S. 14, which belongs to the La Rose Mine. When the question came up for argument it was established that the La Rose Co. had no right to the minerals on the right-of-way, that they were specially excepted in the lease, and that the company paid rental and purchase for only 37 acres, the other 3 acres out of the 40 belonging to the commission. The injunction was therefore refused, and the commission is at liberty to award the right. It is understood that a number of offers have been received. There are also mining rights on some small lots to be disposed of, which the commission has decided to grant to each of the individuals interested, if they wish them.

NOVA SCOTIA.

The Micmac Gold Mining Company is a combination of three properties on the well-known Leipsigate fissure vein, of which Mr. E. R. Faribault of the Geological Survey of Canada, Professor Crosby of the Mass. Institute of Technology and Professor Preswick of Cornell University, have been pleased to take special notice.

The last 21,000 tons or ore taken out of this vein yielded over $216,000.

A meeting of the shareholders of the Breckenridge & Lund Coal Co., was held at Lundbreck, Alta., recently. The company's business was found to be in a very satisfactory condition. A 600 horse power engine and boiler, with up-to-date mining machinery, is now installed, the working shaft is 360 feet deep, and goes through coal all the way down, except about twenty feet of surface. The machinery is capable of lifting screening and shipping 800 to 1,000 tons per day. The coal is a fair domestic coal, and is in great demand wherever it has been tested. The town of Lundbreck is called after the mine.

The installation of the new 100 H. P. Boiler at the Micmac is completed and it will immediately be put into use. The shaft house is now supplied with three boilers of this size and they have just enough power to keep development work going until electric power is brought to the mine.

The drifting for the month of April opened up something over $100,000 in ore. What the management believes to be the record for drifting in quartz and whin-rock, was brokin in the 300 foot level east. This drift was driven 101 feet in 26 double shifts with a MacKiernan 2¼ inch drill, handled by one man. The cost for running this drift was $2.35 per foot, including its proportion of the pumping and hoisting expenses. The 15 stamp mill is running night and day on quartz taken out in development work.

COAL NOTES.

Shipments have been fairly active from Port Hastings.

A census of Frank lately taken shows that town to have a population of slightly under 700 people.

There are two hundred men on the pay roll at the Allan Shafts. The number is being added to daily

According to Mr. Fred. Wanklyn, the Dominion Coal Company will make the largest output of its history this season. The coal is in demand and sales are excellent.

The strike at Springhill was arranged by a compromise. The men asked 38 cents and yardage. They accepted 36 cents straight. This rate should enable them to make a good wage.

The Dominion Coal Co. has a party out surveying a road from their main line to the Company's areas on the Lingan side.

The Inverness Ry. & Coal Co. have purchased a small steamer of light draught for the costal trade.

Shipments from the Springhill Collieries, of the Cumberland Railway and Coal Company for the month of April were 30,980 tons.

The Pacific Coal Co. has ordered two 150 horse power boilers from the Robb Engineering Co. for their mine at Bankhead, Alberta.

The Acadia Coal Company is making extended improvements and additions at the Allan shaft, and expects to have a largely increased output of coal as soon as these improvements are completed.

A C. P. R. surveying party has begun work locating a line to the Diamond Vale Coal Iron Company's mines on Quilchena Creek, through which they pass on their way through Aspen Grove en route to the Similkameen.

Mr. John W. Johnston is manager of the Mabou Colliery, N.S. He was recently in Westville, arranging for shipping facilities during the season. The Mabou coal meets with a ready sale for domestic and steam uses.

The Dominion Coal Company are banking a large quantity of coal at the Dominion No. 2 banking station. The bank there has grown to goodly proportions during the past two weeks. There are upwards of one hundred men employed at the bank, which now amounts to about 250,000 tons.

A. C. Curry, of Rhodes, Curry & Co., Sydney, recently visited Dominion No. 2 Caledonia and the other collieries. The Rhodes Curry Company have a large contract for the erection of miners houses for the Dominion Coal Company. In all, 61 houses are to be built at Dominion No. 2, of which twenty-two are now completed. The Company have commenced work on the houses at Dominion No. 6, of which they have erected over two hundred.

The Crow's Nest Pass Coal Company are putting out from 17 to 18 thousand tons per week and the International Coal & Coke Company at Coleman, which is practically still in its infancy, about 6,500 tons per week. They are selling a considerable quantity of coal to the Canadian Northern for shipment to Edmonton.

The bulk of the Crow's Nest coal goes to the Great Northern Railway company and the C. P. R., besides supplying coke to the smelters.

News comes from the Joggins to the effect that the men have had a proposition made to them by the management for a two years contract on the present basis of pay. The Company are contemplating many improvements, and the investment of considerable new capital, but they do not care to go ahead with labor conditions in uncertainty. The men have been well satisfied with their present pay, and it seems certain they will accept. It is also stated that the company intends paying the back wages due the men by the old company, amounting to about $7,000. Twenty-six per cent. of the original amount was paid several months ago, and it was thought then that this would be the only dividend the men would get. It now seems reasonably certain that they will get all.

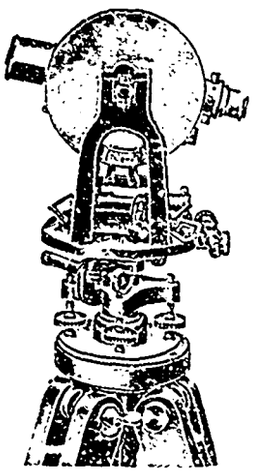
The management of the Acadia Coal Company has employed a large number of men with teams to grade their grounds in the vicinity of the Allan shafts. The large seam of 47 feet thickness is turning out good coal, while the smaller 19 foot seam in No. 2 shaft is also proving excellent. The new steel bank-head will cost $50,000.

Important experiments are being carried on by the naval authorities at Portsmouth to ascertain the extent of the steaming properties of Welsh coal which has been improved by storage in the sea. Eighteen months ago iron crates each containing two tons of coal, were sunk in the big basin in the dockyard. At the same time a similar quantity of coal was carefully stored in the open air at a coaling point and sheltered by tarpaulins. At intervals of six months two ton samples of each storage have been taken carefully and burned. The results have shown conclusively that by the submarine storage of coal its calorific value steadily increases, while by storage in the open air a decided decrease is shown. At naval coaling stations in the tropics the decrease in calorific value is very great.

The Admiralty is satisfied with the physical and financial advantages of submarine storage, and has now directed that experiments be made to ascertain its practicability on a large scale. The difficulty is that submerged coal must be dried before it is used, or otherwise the superficial moisture would soon cause spontaneous combustion. Close confinement in the bunkers of warships is the only method of drying heretofore attempted. Spreading quantities of thousands of tons in the open air has not been feasible.

THE DAVIS PROTECTED TRANSIT.

Every engineer who has had to use surveying instruments in mines or in a difficult country knows how much trouble ,dirt, and dust, and wet can cause. Messrs. J. Davis and Co., Limited, of Derby, England, have brought out a transit instrument specially designed for surveying in metal mines. The principal feature in this is that all the circles, verniers, draw tubes, and screws are protected by metal covers, the verniers being read under glass. The telescope is 7½ in. long, and has a 1 in. aperture, the eye-piece being "18 diameters and inverting." Both the object



glass and eye-piece are protected with mud, rain, and dust guards. There is a 4 in. graduated level under the telescope. The horizontal circle is 4 in. in diameter, and is provided with a double row of figures from 0 deg. to 360 deg. The vertical circle is also 4 in. in diameter. The instrument is made either in gun-metal or aluminium, weighing in the former metal 18 lb. 7 oz., and in the latter 15 lb. 4 oz., the weight of the legs in each case being included. The cut shown herewith gives a good idea of the instrument.

BOOK REVIEWS.

A Guide to Minerals and Rocks.—Prof. Willet G. Miller, Provincial Geologist of Ontario, is the auther of a new book on the study of minerals. This little work comes out at a very opportune moment, having been written for the instruction of those who have but a rudimentary knowledge of rocks, minerals and geological phenomena. Professor Miller occupied the chair of geology in the School of Mining at Queens', and having had a long experience in teaching, is enabled to handle the somewhat difficult subject he has chosen, in a lucid manner.

He deals firstly, with the materials which go to make rocks, and then gives some examples of the occurrence of these rocks in the more get-at-able parts of Canada. He has chosen photographs to illustrate his subjects, and we think they have been well chosen; they are certainly far more illuminating than the usual diagrammatic cuts which are used in such books.

The physical characters of minerals are explained at some length, and the minerals are themselves illustrated from photographs. Characteristic fossils are also shown, and the geological history of the world is touched upon as fully as the limited space at command permits. Moreover, the economic side of the subject is not neglected, while chemical and blowpipe tests are given that should enable any reader of ordinary intelligence to determine the simpler metals. A very good feature of the book is a table giving the commercial value of certain minerals, ores and metals. There is also a good bibliography for the guidance of those who would delve deeper. The Copp, Clark Company are the publishers; the price is $1.00.

Producer Gas.—The latest, and in many respects the most thorough, treatise on Producer Gas and Gas Producers is that by Samuel S. Wyer, recently published by the Engineering and Mining Journal, New York. The use of fuel gas has attracted considerable attention, and important advances and industrial developments have been made therein quite recently. These will be found minutely contained in this well written book. The author is at the head of his profession, and is an acknowledged expert on producer gas. His numerous experiments should prove interesting and useful to all chemists, metallurgists, ga engineers and others who wish to keep themselves posted in an important branch of metallurgy. Price $4.00.

INDUSTRIAL NOTES.

The Golden Horn Mining Company have purchased a Huntington mill from the Allis-Chalmers Bullock Co., of Montreal. The contract calls for delivery this summer.

The Penn Hardware Company, Reading, Pa., are installing a 150 horse power Koerting gas engine to be run on producer gas furnished by a Koerting suction producer. The entire plant is supplied by the De La Vergne Machine Co., New York.

The Rush Bay Golden Horn Mining Co., of Rat Portage, Ont., recently purchased from Allis-Chalmers-Bullock, Limited, Montreal, a mining plant including a Huntington Mill, two Overstrom Concentrators, and Accessory Machinery.

In addition to the office recently established in Oakland, at No. 906 Broadway, the Allis-Chalmers Company, Milwaukee, Wisconsin, has opened quarters in the Atlas Building, 602 Mission Street, "New" San Francisco, where its representatives may be found in readiness to transact all necessary business.

The *Financier and Bullionist*, of London, issued on April 28th a very handsome special Canadian supplement. The great industrial and agricultural development that is going on in the Dominion was laid before the readers of the *Financier and Bullionist* with great detail and considerable utility. Such special specimens should be of value in calling attention to the attractions of Canada as a field for investment.

The Fulton Iron Works, San Francisco, have notified the CANADIAN MINING REVIEW that their entire stock of catalogues, bulletins, circulars and photographs were destroyed in the recent fire in that city. Patrons of the firm will have to wait a little time for bulletins such as the firm has been in the habit of issuing. It will not be long, however, before, with characteristic energy, the Fulton Iron Works will be running as of yore.

A new electrolytic generator, which will have the effect of more than doubling the capacity of the electrolytic refinery of the Canadian Reduction works at Trail, B.C., has been ordered from the Canadian General Electric Company's works at Toronto. The new set is rated at 400 kilowatts. There are two sets of generators in use each being rated at 122½ kilowatts. The new set is, therefore, more than 2½ times the capacity of those in use. The plant ordered will cost $20,000.

Messrs. W. H. C. Mussen & Co., of Montreal, have been given the representation of the Wilfley Ore Concentrator Syndicate's manufactures in Canada. These machines are the Wilfley slime tables and the McDermott sizers. They are consequently the only firm authorized to offer Wilfley tables in the Dominion. Of these tables there are 250 already in use in the different mining camps of the world. The McDermott sizer was designed for a more accurate sizing of crushed before dressing.

The Canadian Rubber Co. of Montreal, Limited, have now placed on the market their new "Keystone" Side Wire Tire. This Tire has many features not to be found in any other make. The company have exclusive control of the patent rights for manufacture and sale throughout the Dominion. A large amount of business has been booked, and the carriage and hack trades are displaying great interest in the new Tire, which is adjudged by experts to be superior to anything yet put on the market.

The Kobbe Company, 1 Hudson Street, New York, are sending out a copy of H. D. Crippen Mfg. Company's new catalogue No. 10, covering the design and application of the Box Electric Drill. In addition it contains full information on electric hoists, blowers, generators and converter sets, in fact it deals with everything required for a complete electric mine installation.

Messrs. Keating & Duncan announce that they have opened offices at the Home Life Building, Victoria Street, Toronto, where they will carry on business as Civil Engineers, special attention being given to Hydraulic, Municipal, Electrical and Industrial undertakings.

The Sullivan Machinery Company, of Claremont, N.H., and Chicago, Ill., has issued a very neat pamphlet, entitled "Coal Mining by Machinery." Its aim is to give a lucid description of the machinery manufactured for coal mining by the Sullivan Machinery Company, together with an outline of the way each machine is used. The Sullivan pick machine, the shearing machine, and the chain electric machines, as well as the Sullivan diamond prospecting core drills and the four-stage and two-stage air compressors, are illustrated and described. This

little publication will be of considerable interest to all those who are engaged in mining coal. It will be sent upon application to the Sullivan Machinery Company, Railway Exchange, Chicago, if the CANADIAN MINING REVIEW is mentioned.

The application of electricity to mining, especially where water power is available, is recognized as a handy and economical method of operation. Among recent sales for this purpose by Allis-Chalmers-Bullock, Limited, Montreal, were a 60 h.p. Induction Motor to drive a two-stage Centrifugal Pump and a 50 h.p. Induction Motor to drive a six-stage Centrifugal Pump, with the necessary Transformers, etc., to the Dominion Copper Co., of Phœnix, B.C.; a 900 h.p., two 300 h.p., a 50 h.p., and a 25 h.p. Induction Motor for general work, and a 40 h.p. Induction Motor to drive a two-stage Centrifugal Pump to the Asbestos & Asbestic Co., of Ranville, Que., and a 75 h.p. Induction Motor driving a Compound Air Compressor for general power purposes and a 115 k.w. Generator for lighting purposes to Blackburn Bros. for their Mica Mines at Perkins Mills, Que.

Toronto is to have the most up-to-date fire fighting apparatus in the Dominion, new turbine pumps and power taking the place of the fire engines. This system has been a complete success in Philadelphia.

The turbine pumps now building have a capacity of 5,000,000 gallons of water every 24 hours, at a maximum pressure of 300 pounds to the square inch. The water will be supplied to a high pressure piping net work, covering the district to be protected.

The pumps are always ready to work—the steam is up—and when fire breaks out, all that is necessary is to couple on the hose to the fire plugs, and the water pours out. This does away with fire engines altogether.

The Canadian Westinghouse Company have the contract for this new pumping station and are supplying two 1,100 horse power Westinghouse-Parsons steam turbines.

The pumps are of the two-stage turbine type and manufactured by The John McDougall Caledonian Iron Works of Montreal.

THE MINING AND INDUSTRIAL SHARE MARKET.

(Specially reported for the *Canadian Mining Review*, by Robert Meredith & Co., Mining Brokers, 57 St. Francois Xavier St., Montreal).

The market has undergone a considerable change, during the past month. Prices are firmer, and the volume of business has largely increased. Encouraging news from the mining districts, and the prosperous condition of the country generally, is creating a confidence in the public in mining ventures, and active speculation in these properties seems nearer at hand, than was anticipated some little time ago.

Reports from the Cobalt district are not of a nature to enthuse the speculator. Outside of the few properties that are being worked, and show good returns, there is no actual mining going on. Prospectors and promoters are asking absurdly high prices for locations, and have practically driven would-be investors away.

In industrial shares there has been only a limited amount of trading, but prices are firmer. The most promising amongst them, are the Dominion Iron & Steel issues. Satisfactory reports of the company's condition have given confidence to the public, and made the shares a more speculative commodity.

The latest quotations are as follows:—

	Bid.	Asked.
Can. Cons. Mines	128	132
Can. Gold Fields	06¾	07¼
Granby Cons.	12½	12¾
Rambler Cariboo	23	23½
North Star	01	——
Monte Cristo	02¼	03
White Bear	06	06½
California	02	——
Virginia	02	05
Deer Trail	01¼	02½
International Coal	47	49
Sullivan	02¼	03¼
Jumbo	25	26
Cariboo-McKinney	02¼	03
Dominion Coal (common)	78	79
Dominion Coal (preferred)	119	120
Dominion Iron & Steel (common)	30	30½
Dominion Iron & Steel (preferred)	82	83
Intercolonial Coal (common)	——	——
Intercolonial Coal (preferred)	——	——
Nova Scotia Steel & Coal	67	67½
Nova Scotia Steel & Coal (preferred)	——	——

MINING INCORPORATIONS.

ONTARIO AND QUEBEC.

Canadian Iron & Foundry Company, Ltd.—Capital $2,000,000.00 in shares of $100.00 each. Head Office, Montreal.

The Montreal Reduction & Smelting Company, Ltd.—Capital $2,000,000.00, in shares of $5.00 each. Head Office, Montreal.

The Mining and Lands Development Company, Ltd.—Capital $40,000.00, in shares of $100.00 each. Head Office, Toronto. Provisional Directors: Messrs. William Alfred Preston, William James Elliott and Robert Davidson Hume.

Hudson Bay Extended, Limited.—Capital $50,000.00, in shares of $1.00 each. Head Office, Toronto. Provisional Directors: Mr. John Walter McDonald, Ella Alexandria Francis and Mary Ann McKessock.

The Amalgamated Petroleum Producers, Limited.—Capital $40,000.00, in shares of $50.00 each. Head Office, Belleville, Ont. Provisional Directors: Messrs. Cameron Brown, Hugh Quinlan and William Nesbitt Ponton.

Mining Development and Securities Company, Limited.—Capital $150,000.00, in shares of $1.00 each. Head Office, Toronto. Provisional Directors: Messrs. Walter Herbert Gates, Edward Stuart, Clifton Griffith, and Harvey Nelson Barry.

Silver Ledge, Limited.—Capital $20,000.00, in shares of $10.00 each. Head Office: Toronto. Provisional Directors: Messrs. Alexander Montgomery, Ewart Reginald Lynch and Alice Scott.

North Cobalt Land Corporation, Limited. Capital $40,000.00, in shares of $1.00 each. Head Office, Toronto. Provisional Directors: Messrs. Geo. Stevenson, William James Clark, Mary Lambert, Annie Bell and Emeline Roberston.

Findlay Mining Company, Limited.—Capital $20,000.00, in shares of $1.00 each. Head Office: Windsor. Provisional Directors: Messrs. Luke Hitchcock Broadwater, Job Grafton Kimmell and Terrance McManus.

Iroquois Cobalt-Silver Mining Company, Limited.—Capital $100,000.00, in shares of $1.00 each. Head Office: Haileybury, Ont. Provisional Directors: Messrs. Charles Arthur Richardson, Joseph Law Wheeler and Harvey Driffill Graham.

The Silver Cliff Mining Company, Ltd.—Capital $2,000,000.00, in shares of $1.00 each. Head Office: Ottawa. Provisional Directors: Messrs. Walter Dymond Gregory, Henry Folwell Goodheram and Harvey Nelson Barry.

Silver Wonder Mining Company, Limited.—Capital $300,000.00, in shares of $1.00 each. Head Office: Toronto. Provisional Directors: Messrs. Archibalt Thomas Struthers, Lachlan Mackay and William Henry Syms.

The Buffalo Mines, Limited.—Capital $1,000,000.00, in shares of $1.00 each. Head Office; Toronto, Ont. Provisional Directors: Messrs. Alexander McLean Macdonnell, Arthur Carson McMaster and Thomas Herbert Barton.

Glen Lake Mining Company, Limited.—Capital $500,000.00, in shares of $1.00 each. Head Office: Toronto, Ont. Provisional Directors: Messrs. Alexander McLean Macdonnell, Arthur Carson McMaster and George Reginald Geary.

The Lake Abitibi Navigation and Trading Company, Limited.—Capital $40,000.00, in shares of $100.00 each. Head Office:Parry Sound, Ont. Provisional Directors: Messrs. John Galna, William Fritz Thomson and William Ross Smyth.

Beaver Silver Cobalt Mining Company, Limited.—Capital $500,000.00, in shares of $1.00 each. Head Office, New Liskeard, Ont. Provisional Directors: Messrs. Andrew Devine, Kalil Farah and Louis Vineberg.

Dominion Cobalt Mining and Development Company, Limited.—Capital $150,000.00, in shares of $1.00 each. Head Office: Cobalt, Ont. Provisional Directors: Messrs. Robert Kenneth Lindsay, John Thomas Later, Walter Williams,

The University Mines, Limited.—Capital $1,000,000.00, in shares of $10.00 each. Head Office: Toronto. Provisional Directors: Messrs. Geo. Glendinning, William John Blair and Hugh Livingstone Kerr.

The Columbus Cobalt Silver Company, Limited.—Capital $150,000.00, in shares of $1.00 each. Head Office: Toronto, Ont. Provisional Directors: Messrs. Harry Sydney Pritchard, Frederic Watt and Frederick Clarence Jarvis.

North Range Nickel and Iron Mining Company, Limited.—Capital $1,000,000.00, in shares of $1.00 each. Head Office: Sudbury, Ont. Provisional Directors: Messrs. William Joseph Bell, Alexander Burton Gordon and Joseph Morin.

The Albert Mining Company, Limited.—Capital $375,000.00, in shares of $1.00 each. Head Office, Toronto, Ont. Provisional Directors: Messrs. Samuel James Pickering, William John Brown and John Lewis.

The Cobalt Chartered Company, Ltd.—Capital $350,000.00, in shares of $1.00 each. Head Office, Haileybury, Ont. Provisional Directors: Messrs. Frank Law, Allan Lebeau, Edward Eugene Belcourt, Joseph Napoléon Rattey and Henri Letourneau.

The McKinley-Darragh-Savage Mines of Cobalt, Ltd.—Capital $2,500,000.00, in shares of $1.00 each. Head Office, Toronto. Provisional Directors: Mr. Geo. Wishart Spence, Ada May Duncan, Ada Agnes Rogers, Lilian Murray Heal and Susan Whittaker.

Cobalt and Hudson Bay Development Company, Limited.—Capital $100,000.00, in shares of $1.00 each. Head Office: Haileybury, Ont. Provisional Directors: Messrs. James Edward Day, John Michael Ferguson, Edward Vincent O'Sullivan, Arthur Herbert Day and John Joseph O'Sullivan.

The Cobalt Standard Mining Exchange, Limited. Capital $40,000.00, in shares of $10.00 each. Head Office: Cobalt, Ont. Provisional Directors: Messrs. John Walter McDonald, Herbert Langell Dunn, Albert Ernest, James Blackman, Ella Alexandria Francis and Mary Ann McKessock.

The Eureka Silver Mining Company, Limited.—Capital $100,000.00, in shares of $1.00 each. Head Office: New Liskeard, Ont. Provisional Directors: Messrs. Byron Field, Edward Milton Goodman, James Leitch Brown, Robert Herron and Henry Hartman.

The Silver Crown Mining Company, Limited.—Capital $500,000.00, in shares of $1.00 each. Head Office: North Bay, Ont. Provisional Directors: Messrs. Robert Handley, John James Connolly, Charles James Murphy, Charles James Roberts and William Pennington Allum.

The Steep Rock Development Company, Limited.—Capital $150,000.00, in shares of $1.00 each. Head Office: Fort Frances, Ont. Provisional Directors: Messrs. David Croal McKenzie, Alexander Mills, Thomas Rawn, George Webster and Adeliner Snyder.

Montreal River Silver Syndicate, Limited.—Capital $200,000.00. Head Office: Toronto, Ont. Provisional Directors: Messrs. William Hamilton Wylie, William John Aikens, Richard Thomas Mussen, Charles Exley Calvert and William Thomas Henderson.

The Gilpin Cobalt-Silver Mining Company, Limited.—Capital $500,000.00, in shares of $1.00 each. Head Office, Toronto, Ont. Provisional Directors: Messrs. Arthur Albert Daniel, Robert Frederick Wilton, D'Arcy Bolton Gilpin and Mildred Wessonah Mayer.

The Sudbury Cobalt Mining Company, Limited.—Capital $300,000.00 in shares of $1.00 each. Head Office: Sudbury, Ont. Provisional Directors: Messrs. John Timothy O'Connor, Delphis Matthew Morin, Lawrence O'Connor, Norman Thorquil Hillary and James Arthur Mulligan.

The Cross Lake-Consolidated Mining and Milling Company, Limited. Capital $1,000,000.00, in shares of $1.00 each. Head Office, Toronto, Ont. Provisional Directors: Messrs. Frederick Rielly, Henry Mortimer Murton, John Bogert Bartram, Grace Sutherland and Edna Denton.

Wendigon Silver and Copper Mining Company, Limited.—Capital $400,000.00, in shares of $1.00 each. Head Office: Windsor, Ont. Provisional Directors: Messrs. Andrew Green, John Alexander Hunt, James Wesley Hanna, John Wigle and Albert Dumouchelle.

Argentite Mining and Smelting Co., Limited.—Capital $1,000,000.00, in shares of $100.00 each. Head Office: Toronto. Provisional Directors: Messrs. Geo. Charles Loveys, William Beardsley Raymond, Frank Ford, John Francis Hope McCarthy and James Miller Ewing.

Lawson Cobalt Silver Mining Company, Limited.—Capital $500,000.00, in shares of $1.00 each. Head Office: Eganville, Ont. Provisional Directors: Messrs. Walter Lawson, Donald Fisher McGregor, John Brady, Duncan James McEwan and John Leopold George.

Ontario Iron and Steel Company, Limited—Capital $500,000.00 in shares of $100.00 each, of which two thousand five hundred shares to be Preference Shares. Head Office: Toronto, Ont. Provisional Directors: Messrs. David Muhlfelder, Joseph Lippman Steefel and William Manley German

Wolstrees Cobalt Silver Mining Company, Limited.—Capital $250,000.00, in shares of $1.00 each. Head Office: Windsor, Ont. Provisional Directors: Messrs. John William Wolst, Frederick Stephen Kratzet, Anthony Brinkmann, Charles Olin Campbell, Alexander Campbell, Francis Herbert Warren and George Henry Hett.

The Windsor Dredging Company, Ltd —Capital $40,000.00, in shares of $100.00 each. Head Office, Windsor, Ont. Provisional Directors: Messrs. Albert Frederick Healy, Adolphe Peltier, William Johnson McKee, Henry Wm. Allan, Arthur Bertram Drake, Geo. Erasmus Brooks and Walter Leishman McGregor.

The Green Rock Mining Company, Limited.—Capital $600,000.00, in shares of $1.00 each. Head Office, Sault Ste. Marie, Ont. Provisional Directors: Messrs. Charles S. McLachlan, John Burk Kelly, William Henry Darcy, James Johnson Lyon, George Franklin Wheatley, Robert Chadwick and Robert Henry.

The Detroit & Cobalt Development Company, Limited.—Capital $25,000.00 in shares of $100.00 each. Head Office: Windsor, Ont. Provisional Directors: Messrs. John Lawrence Ernst, Clarence Howard Gowman, William Henry Lehman, Alexander Gould Thomson, Timese Lemay and Orrin Preston Gulley.

The Ohio Cobalt Mining Company, Ltd.—Capital $60,000.00, in shares of $10.00 each. Head Office: Haileybury, Ont. Provisional Directors: Messrs. Howard Hugo Smith, John Charles Ross, Benjamin Rush Dawson, William B. Franey, Andrew Scott Buckingham, Robert Morse Franey and Hervey Garrett Mooney.

BRITISH COLUMBIA.

The Phœnix Amalgamated Copper Mines, Limited.—Capital $5,000,000.00, in shares of $10.00 each.

Bear Hydraulic Mining Company, Limited. Capital $250,000.00, in shares of $1.00 each.

Canada Western Oil Company, Limited. Capital $500,000.00, in shares of $1.00 each.

Phœnix Amalgamated Copper Mines, Limited.—Capital $5,000,000.00, in shares of $10.00 each.

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All mines belong to the government of the Province on all unsold lands and on all those sold since the 24th of July 1880 but gold and silver are always reserved, whatever may be the date when the land was sold, unless it be otherwise mentioned in the patent.

The government grants PROSPECTING LICENSES for lands on which the mines belong to it, giving the holders of such licenses the first right to purchase the mines. In the case of lands where the surface alone is sold, the owner of the surface may be expropriated if he refuses an amicable settlement.

The price of prospecting licenses is $5.00 per 100 acres on surveyed lands and per square mile on unsurveyed lands. If the surface has already been sold, the price is only $2.00. They are valid for three months and are renewable at the discretion of the Minister.

When mines are discovered, they can be bought or leased from the government. The purchase price is as follows:

Mining for superior metals on lands situate more than 12 miles from a railway in operation, $5.00 per acre and on lands situate less than 12 miles from such a railway, $10.00 per acre;

Mining for inferior metals—the price and the area of the concessions are fixed by the Lieutenant Governor in council.

The words "superior metals" include the ores of gold, silver, lead, copper, nickel and also graphite, asbestos and phosphate of lime; and the words "inferior metals" mean and include all the minerals and ores not included in the foregoing definition and which are of appreciable value.

MINING CONCESSIONS are sold in entire lots in surveyed townships or in blocks of not less than 100 acres in unsurveyed territories.

Patents are obtained subject to the following conditions: The full price must be paid in cash; specimens must be produced and accompanied by an affidavit; a survey at the cost of the applicant must be made on unsurveyed lands; work must be bona fide begun within two years.

Mining licenses giving the right to work the mine and dispose of its products, are granted on payment of a fee of $5.00 and a rent of $1.00 per acre per annum. Such licenses are valid for one year and are renewable on payment of the fee and of the same rent. They may cover from 1 to 200 acres for one and the same person and must be marked out on the ground by posts. The description or designation must, however, be made to the satisfaction of the Minister.

Persons working mines must send in yearly reports of their operations to the government.

The attention of the public is specially called to the new territory north of the height of land towards James Bay, which comprises an important mineral belt in which remarkable discoveries of minerals have already been made and through which the New Grand Trunk Pacific Railway will run.

The Government has made special arrangements with Mr. Milton L. Hersey, 171 St. James Street, Montreal, for the assay and analysis of minerals at very reduced rates for the benefit of miners and prospectors in the Province of Quebec. Tariffs of assays can be obtained on application to him.

The Bureau of Mines at Quebec, under the direction of the Superintendant of Mines will give all the information asked for in connection with the mines of the Province of Quebec and will supply maps, pamphlets, copies of the law, tariff for assays, etc., to all who apply for same.

Applications should be addressed to:

THE HON. MINISTER OF COLONIZATION, MINES AND FISHERIES,

PARLIAMENT BUILDINGS, QUEBEC

DOMINION OF CANADA

SYNOPSIS OF CANADIAN NORTH-WEST MINING REGULATIONS.

COAL—Coal lands may be purchased at $10 per acre for soft coal and $20 for anthracite. Not more than 320 acres can be acquired by one individual or company. Royalty at the rate of 10 cents per ton of 2,000 pounds shall be collected on the gross output.

QUARTZ—A free miner's certificate is granted upon payment in advance of $7.50 per annum for an individual, and from $50 to $100 per annum for a company, according to capital.

A free miner having discovered mineral in place, may locate a claim 1,500 feet x 1,500 feet.

The fee for recording a claim is $5.

At least $100 must be expended on the claim each year, or paid to the mining recorder in lieu thereof. When $500 has been expended or paid, the locator may, upon having a survey, made, and upon complying with other requirements, purchase the land at $1 an acre.

The patent provides for the payment of a royalty of 2½ per cent. on the sales.

Placer mining claims generally are 100 feet square ; entry fee $5, renewable yearly.

A free miner may obtain two leases to dredge for gold of five miles each for a term of twenty years, renewable at the discretion of the Minister of the Interior.

The lessee shall have a dredge in operation within one season from the date of the lease for each five miles. Rental $10 per annum for each mile of river eased. Royalty at the rate of 2½ per cent. collected on the output after it exceeds $10,000

W. W. CORY,
Deputy of the Minister of the Interior.

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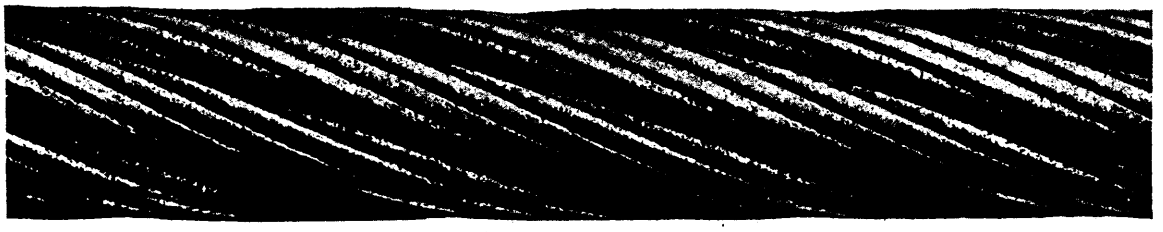

Illustration of Winding Rope, 240 fms. long x 3½ circ., Galvanized Special Improved Patent Steel, Compound make, supplied to Kenneil Collieries, Bolness, Scot., which gave a record life of 6 years and 2 months. Showing condition when taken off.

TELEGRAMS—"Ropery Rutherglen." A B C, A I and Lieber's Codes used.

AGENTS IN CANADA:

Wm. Stairs, Son & Morrow, Ltd., Halifax, N.S.
W. H. Thorne & Co., Ltd., Saint John, N.B.
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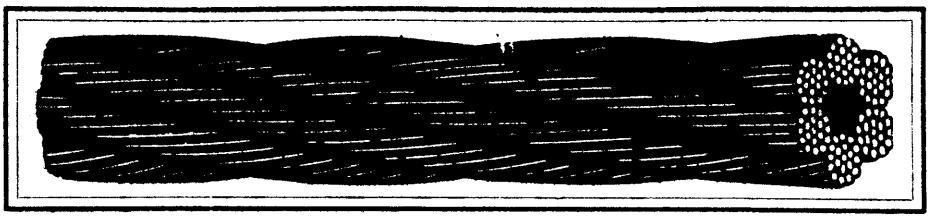

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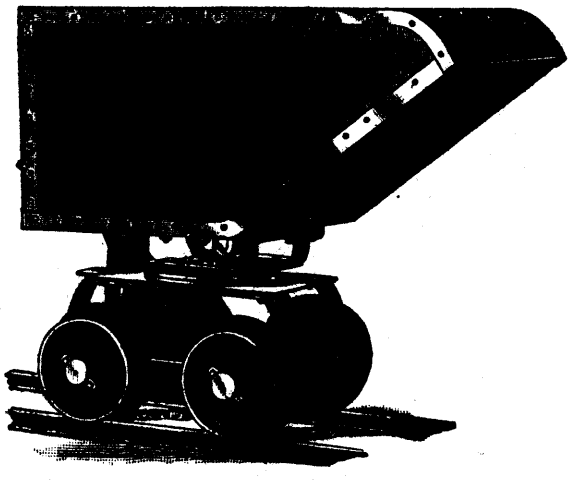

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