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CIRCULATION.

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THE CANADIAN MINING INSTITUTE

This week there will be held in Montreal the annual meeting of the Canadian Mining Institute. Members are urged to be present, and they should take advantage of the privilege of bringing friends who are interested in mining. Invitations may be secured on application to the Secretary. The meeting is to be held at the Ritz-Carlton Hotel, where special rates for members have been arranged for.

The council reports for 1913 another very successful year. At the meeting in Ottawa last March there was a large attendance. Branch meetings were held at Montreal, Toronto, Cobalt, Lethbridge, Frank, Rossland and Nanaimo. In addition to the annual volume an Index to Transactions was published. The Index cost, according to the Treasurer's report, $1,606.02. Fewer papers were published in advance form than in previous years, the council having decided that economy demanded this.

The Index was prepared by the Secretary, Mr. Mortimer-Lamb. It is a useful source of reference to the papers published in Volumes 1 to 10. In addition to the general index there are summaries of the papers.

The annual volume comprises 660 pages, is well illustrated and is printed on good paper. It is, as Dr. Barlow points out, a much more costly volume than was published a few years ago.

The membership on Dec. 31, 1913, was 1,029, as compared with 1,035 on Dec. 31, 1912. The decrease was in the number of affiliated students. The number of ordinary members increased.

A notable feature of the Institute's activities during the year was the International Geological Congress. As Mr. Lamb points out, the Institute was not officially responsible for the conduct of the meeting; but much of the work was done by members of the Institute. The Council recognized that the Congress meant much to the mining industry in Canada and acted accordingly.

In the students' competition eight papers were submitted. The President's gold medal and the first prize of $25 were awarded to Mr. C. W. Greenland of the School of Mining, Kingston. Mr. P. P. Baily of McGill University was awarded second prize. Messrs. C. S. Parsons of the School of Mining and Mr. E. E. Billington of McGill were awarded honorable mention.

The Canadian Mining Institute has a good name for what it has accomplished, and it is gradually growing in usefulness. It represents the mining industry in Canada and can claim to have as a rule represented it well.

There are, however, occasions when it becomes apparent that some members are of the opinion that a

number of reforms are desirable. It is to be expected that there will be much difference of opinion. This has been provided for by endeavoring to make the Council a truly representative body. Some are of the opinion that the methods of election do not guarantee this. Some complain that they are not kept reasonably well informed of the action of Council. Some complain that other reforms are needed.

It would be well if members who have reforms to suggest would make their suggestions to the Council in order that they be given due consideration. And it would be well if the Council would keep members better informed as to their actions. A little publicity would probably show that some of the grievances are ill-founded and that others could be easily remedied. As a rule the criticisms offered are not on very important matters, and are hardly worthy of the attention of the annual meeting.

As a rule Institute affairs run along very smoothly, and would probably continue to do so without radical changes in methods. Difficult questions have arisen frequently and have been successfully disposed of. There are, however, always some discontented members. Greater endeavor might be made to remove the reasons for discontent. Possibly similar reasons are responsible for some good mining men in Canada not joining the Institute.

The retiring president, Dr. A. E. Barlow, has long been an enthusiastic supporter of the Institute. He has given much of his time to furthering its interest and will be able to present a good report. His successor is Mr. G. G. S. Lindsey. Mr. Lindsey is not a geologist, but is otherwise well qualified for the position.

SINKING SHAFTS IN WET GROUND

Among the papers presented at the New York meeting of the American Institute of Mining Engineers was the one on grouting which appears elsewhere in this issue. The author gave a very interesting account of the successful exclusion of water from underground openings. He believes that the methods used are applicable in many cases. The chief difficulty is in sandy ground.

Where the openings are in rock, as most mine openings are, the use of cement grout for the exclusion of water is well worthy of consideration. There are many obvious advantages to be gained by preventing the flow of water into shafts. If it can be economically done, as Mr. Donaldson believes, there is reason to believe that it will become common practice.

THE EIGHT-HOUR SHIFT

Since December 1, 1913, the underground employes of the Michigan copper mining companies have been required to work only eight hours each day. In a recent issue we stated, in error, that the law required this. A bill providing for the eight-hour shift was under discussion last summer; but was not passed by the State Legislature. Some time later, however, after the Western Federation strike was declared, the mine managers announced that they were willing to grant the demand for an eight-hour day. They had had this under serious consideration for some time, and might have granted it without a strike if they had not found that it is much more difficult to put the eight-hour rule in force than might be expected. There can be little doubt that the strike hastened the determination of the mine managers to try the experiment.

The Michigan copper mines are, by those who know, regarded as mines in which the conditions are very favorable for good work. The ventilation, in spite of the depth of the mines, is good. The machines are usually the best obtainable and are kept in good repair by skilled mechanics. The steel, powder and other supplies used are those which are found by constant testing to give the best results. The managers believe in doing everything possible to increase the efficiency of the workers. Under the conditions obtaining a miner should be able, and is able, to do a good day's work in eight hours.

As a matter of fact there is good reason to believe that few of the miners on company account really worked more than eight hours under the old regulations. The workmen in a large mine are in small groups so far apart that no reasonably economical system of watching the men as is done on surface work is possible. Only occasionally are the workers visited by the shift bosses. They must be judged by the work done between visits. While frequent complaints are made regarding the treatment by bosses, it must be evident that no such surveillance as is practised by foremen on surface work, such as railroad construction, is possible. There are abundant opportunities for loafing. It would be remarkable if the men did not take advantage of such opportunities. The experience of mine managers has proven that mine workers are much like other men.

It is easy to conclude therefore that the results to be obtained under the new regulations depend largely on the spirit in which the men accept the change. In proportion as they work a larger percentage of the time they are supposed to work, the total work done in the shorter shift will approach the old figures. The systematic records of the Michigan copper mining companies should prove very interesting in this connection.

While the strike seems to have failed, and has, owing to the methods of those responsible for it, been a disgrace to organized labor, it has doubtless hastened the adoption of new policies which should make the life of the copper miner more attractive.

AMERICAN INSTITUTE OF MINING ENGINEERS

The annual meeting of the American Institute of Mining Engineers was held in New York February 17-20, 1914. Those present, and there was a large

attendance, showed that they were much pleased with the progressive manner in which the Institute's affairs have been carried on by the officers during the past year. An energetic campaign to increase the membership resulted in several hundred applications being filed. An unusually large number of interesting papers were presented during the year. Nearly 500 members are on the many committees appointed.

Some members doubt the advisability of the methods of our American friends. They fear that the enthusiasm will not last and that the reaction will outweigh the good that has been done. So far, however, there is little ground for such fear. The members, as a rule, though not all by any means, are apparently confident that the revival has been a good thing for the Institute. The several hundred new men are well qualified, most of them having good technical training and several years' experience in mining.

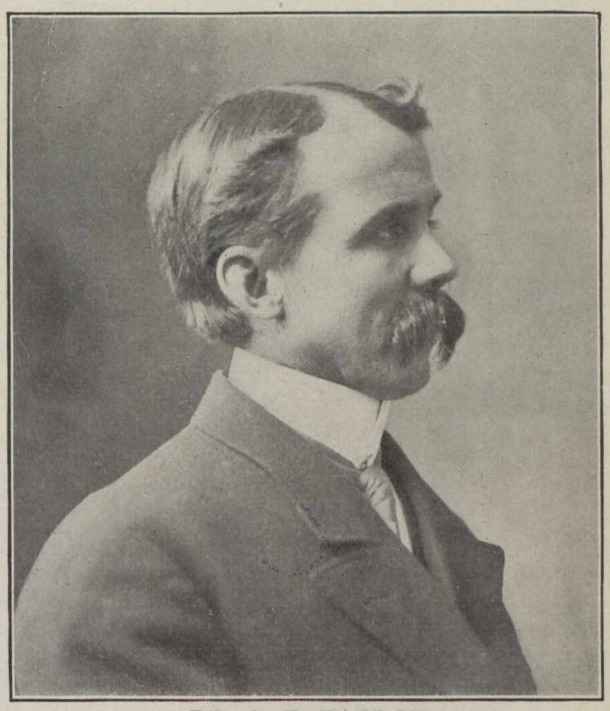
During the past year many Canadians were invited to join the American Institute and several did. As a result of this, and more particularly on account of the way in which members were asked to take part in the campaign, there has been some criticism by Canadians of the American methods.

The criticism was taken seriously by the officers of the American Institute and a committee was appointed to confer with a committee of the Canadian Mining Institute on the matter. There does not appear to be any good reason for such action. The American Institute does not enter Canada under any more favorable terms than the Canadian Institute enters the United States. There are Canadian members of the American Institute and American members of the Canadian Institute, and it is generally acknowledged that this is as it should be.

If Canadian members of the American Institute of Mining Engineers wish to criticize the methods of the officers of that Institute they can do so just as do American members. Why should the matter be taken up with the Canadian Mining Institute? Apparently the criticism by a few members is being mistaken for criticism by Canadian members in general. The officers of the American Institute are taking the matter seriously, as they do not wish their activity to be misunderstood.

Under the heading "Fifty Years Ago To-day," The Daily Colonist, Victoria, B.C., lately included in the news items quoted from The Colonist of January 27th, 1864, the following: "Annual Gold Shipment—The gold shipments from Victoria to San Francisco for the year 1863 were $4,500,000, $10,000 of which went to San Francisco, then to New York, and the rest went to England, to avoid the war risk." In this connection, it is of interest to note that the Annual Report of the Minister of Mines shows the value of placer gold produced in the Province in 1863 to have been $3,913,563.

It has been announced that a committee of the Association of Bituminous Coal Operators of Central Pennsylvania, is considering the question of bringing action against the United Mine Workers of America as an organization, and leading members individually for alleged violation of a contract between the operators and the union miners in the Central Pennsylvania district. The operators state that more than 100 strikes have occurred in the district through the efforts of miners to unionize workers in the mines, and that the strikes are maintained by the miners' unions supplying the strikers with relief pay.



DR. A. E. BARLOW
President Canadian Mining Institute

MR. G. G. S. LINDSEY
President-elect

CORRESPONDENCE

EMPLOYERS' LIABILITY.

The Editor, The Canadian Mining Journal,
Toronto, Ont.:

Sir,—As, of course, you are aware, for some years past the Canadian Mining Institute has displayed a keen and practical interest in the movement to promote safety in mines. It will be agreed that mining corporations voluntarily adopting measures to minimize the dangers of mining and to ensure the safety of their employes should receive every encouragement. In the Bill about to be introduced to the Ontario Legislature relative to Employers' Liability and Workmen's Compensation, no discrimination is, I believe, made between mining companies that are safeguarding their employes in this respect and those that are not. May I suggest that this is scarcely fair. Those corporations that are making large expenditures annually to prevent, or, at least reduce, the risk of accidents at their mines and works should surely not be required to contribute in an equal degree towards covering the liability of employers elsewhere in the Province who have taken no such precautionary and humanitarian measures. In this Bill, a classification of mining companies under two heads—those that adopt safety methods and those that do not—would, therefore, not only be a just provision, but an incentive towards a more general introduction of "safety principles and practices."

H. MORTIMER-LAMB.

NEW PROVISIONS IN PETROLEUM AND GAS REGULATIONS.

By order in Council, January 14th, 1914, the following new provisions have been inserted in the Dominion petroleum and natural gas regulations:

1. No application for a lease shall be accepted or recorded unless it is accompanied by the full amount of the rental for the first year, viz.: 25 cents per acre.

2. Provision is made for the consolidation of operations and expenditure on a group of leases where more than one have been acquired by assignment or otherwise, provided that such consolidation shall only apply to the second and third years of the term of the lease, and shall comprise only such leases as may, at that time, be included in such consolidation. The group shall not exceed an area of 20 square miles, nor shall the locations be separated from each other by more than two miles.

3. Provisions are made with regard to preventing access of water to the oil-bearing formation and that all reasonable precautions be taken to guard against the waste of natural gas.

4. Any company acquiring leases shall at all times be and remain a British company, registered in Great Britain or Canada; the Chairman and a majority of the directors shall, at all times, be British subjects and the Company shall not at any time, become, directly or indirectly, controlled by foreigners or by a foreign corporation.

5. The Minister may at any time, if considered necessary by the Government of Canada, assume absolute possession and control of any location, together with plant, equipment, etc.

6. If oil in paying quantities is discovered, the lessee shall work the wells uninterruptedly in accordance with the provision of these regulations and to the satisfaction of the Minister so long as the wells yield oil in paying quantities.—W. J. D.

SALT.

Extensive beds of salt or salt producing springs are found in nearly every province of the Dominion of Canada.

The largest and at present the only producing district, is situated in the south-western peninsula of the Province of Ontario, bordering on Lake Huron, the St. Clair River, Lake St. Clair, and the Detroit River. The salt here exists as beds in the Salina formation of the Silurian system, which formation in the productive area is covered by upwards of 1,000 feet of other strata, chiefly Devonian.

In this district the principal plants are located at Windsor, Sarnia, Sandwich, Goderich, Clinton and Kincardine. A prominent feature of the salt produced from the brine in Canada is its remarkable purity and also its freedom from other salts detrimental to its use in the production of caustic soda and bleaching powder. There is a good opportunity for the soda industry in the Dominion and it is assuming larger proportions each year. At Sandwich, a plant has been recently erected for the manufacture of caustic soda and bleaching powder from the brine.

The production in Canada is obtained wholly from the evaporation of salt brines, either natural or else formed by the pumping of water down drill holes to the salt beds and the re-pumping of the water when it has become a saturated solution.

MICA.

The amber mica deposits of Canada are comprised within an area of approximately 1,200 square miles in the Province of Quebec, and 900 square miles in the Province of Ontario. The two districts are separated geographically by the Ottawa River, and geologically by a belt of sedimentary rocks about 40 miles wide. The City of Ottawa lies between the two productive areas, and is the seat of the mica industry—all the important works engaged in trimming and in otherwise preparing the mineral for the markets being located in that place.

Deposits of white mica also occur in Canada, and occurrences of this variety (some few of which have been worked at various times), are known from Labrador in the east to the Rocky Mountains in the west, while several Arctic expeditions have returned with good specimens from the far north.

Though the average dimensions of mica sheets do not much exceed 3 x 5 inches, plates of enormous size are sometimes obtained. Crystals have been found which measured over 4 feet across and weighed nearly two tons.

About 300 mines have been worked for mica at various times in Canada, but at the present day no more than 25 are in active operation. Among the large operators may be named: The General Electric Company, of Schnectady, N.Y.; Webster & Company, Ottawa; Blackburn Bros., Ottawa; Wallingford & Company, Ottawa; O'Brien & Fowler, Ottawa; Kent Bros., Kingston.

GRANBY.

Total shipments from the Granby mines at Phoenix, B.C., have now reached a total of 10,000,000 tons.

Mail carriers at Elk City, Idaho, were recently informed that owners of mining properties had three carloads of concentrated ore awaiting shipment by parcel post to the smeltery, a distance of 60 miles over mountain roads.

Members of C1 and C2 Excursions at Alexandra Club, Victoria, B.C.

Members at the University of Toronto, Headquarters During the Toronto Session.

ELECTRIC SMELTING OF CANADIAN IRON ORES

By T. R. Loudon, Toronto.

It is a well known fact that Canadian iron ores are not well suited for smelting in the ordinary blast furnace. For the most part these ores are magnetic and contain high percentages of undesirable elements such as titanium, phosphorus and sulphur, or are very siliceous. Magnetic separation has been tried in order to rid the ores of the greater proportion of this "gangue" and experiments along these lines are still in progress; but, so far, although technically successful results have been obtained, no very marked commercial success has been made. In many cases, even where separation has been used, it was still necessary to either briquet or nodulize the fine particles of ore, which, without this treatment, would simply be carried out of the furnace by the blast.

Since the introduction of the electric furnace into the steel industry, it has been well recognized that these Canadian ores could be smelted by electro-thermic means. In 1906, the Dominion Government issued the results of extensive investigations on the electric furnace iron and steel industry of Europe. This investigation was followed by a series of experiments at Sault Ste. Marie with a view to utilizing Canadian magnetite ores. The furnace used in these experiments was simply an enlarged pot into which dipped a vertical carbon electrode, the other terminal being made by the hearth of the furnace, which was built of a carbonaceous material as shown in Fig. 1. The charge was placed around the vertical electrode and reduction took place mainly at the lower part of the furnace, the gases resulting from the reactions escaping freely from the top. Although these experiments were technically satisfactory, yet it was seen that great improvements would have to be made in order to operate on a commercial scale. For instance, the escape of the gases from the top of the furnace represented a great heat loss. The charge also had a tendency to clog. In fact, the vertical electrode passing through the charge was seen to be impossible.

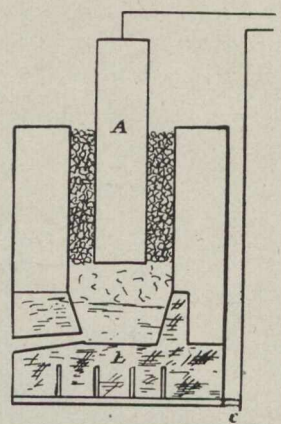


Fig. 1. Experimental electric furnace at Sault Ste. Marie, Ont.

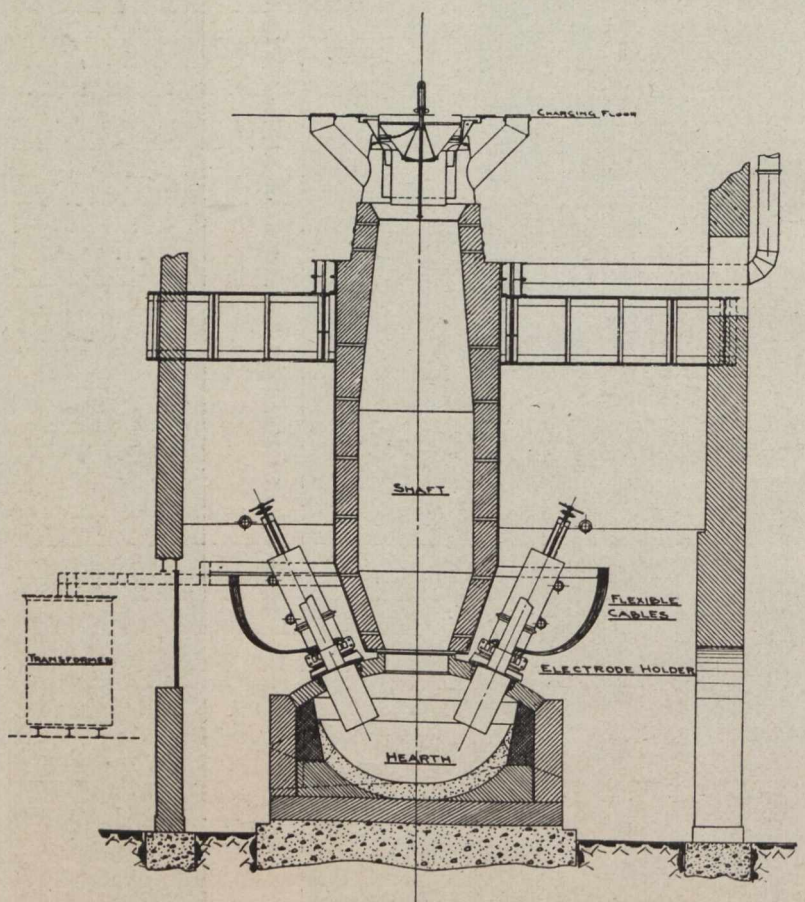


Fig. 2. A Swedish electric furnace

Since the publishing of the results of these investigations, nothing has resulted commercially in Canada; but, as a direct result of the experiments mentioned

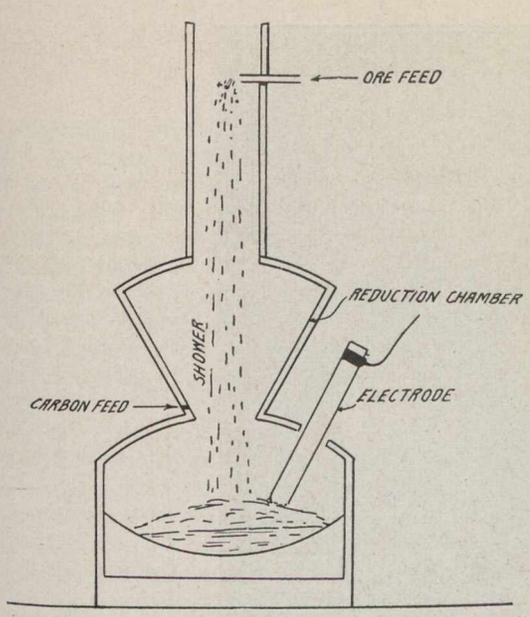


Fig. 3. Moffat-Irving electric furnace

above, a commercially successful process for the smelting of iron has been evolved in Sweden. This furnace, a cut of which is shown in Fig. 2, is a structure similar in outline to the upper part of an ordinary blast furnace, this portion being superimposed upon a crucible into which the electrodes project. This furnace was running successfully in 1911, and since then the field of operations has been very much extended.

There are, of course, many economic reasons why the electric furnace has not been more enthusiastically received in Canada in the steel industry; but, the fact that the processes require operators of experience has, perhaps, been the greatest reason why nothing has been done of any account. Those having the necessary experience are few and far between. Much investigation, however, has been independently carried on, and the new plant of the Moffat-Irving Steel Co., Toronto, is the result of such research.

The Moffat-Irving Electric Furnace.

The furnace used in this plant is diagrammatically shown in Fig. 3. Fig. 4 is a photograph of the original crucible. Fig. 5 is a view of the final furnace which, it will be seen, differs merely in detail from the original construction.

Fig. 4. The Moffat-Irving—The original crucible

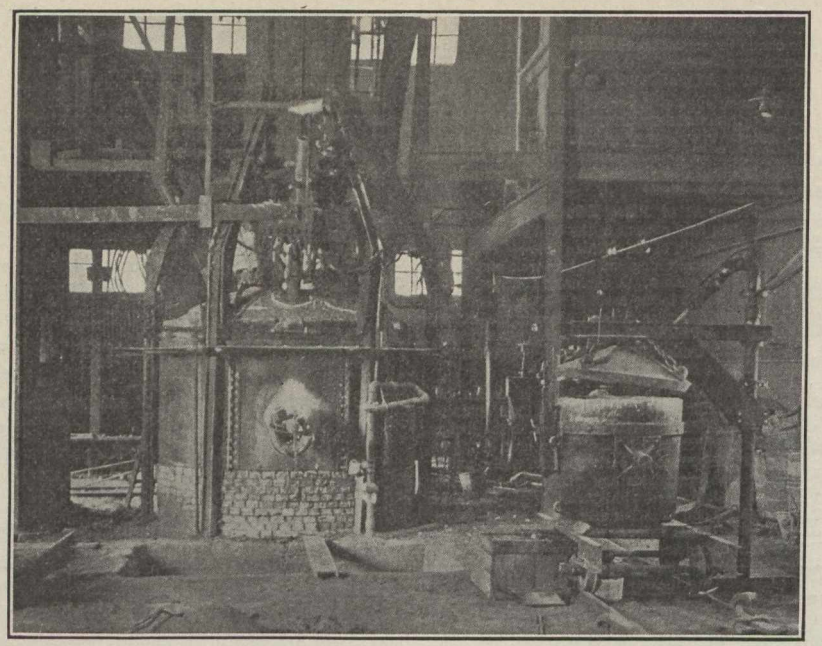


Fig. 5. Moffat-Irving electric furnace—The final furnace

As indicated in Fig. 3, the ore particles are fed into the upper stack by mechanical means. The requisite limestone is also fed in at the same level. The carbon, in the form of finely ground coke, is fed into the crucible at the lower level indicated. In falling, the ore particles come in contact with a strongly reducing hot atmosphere of carbon monoxide gas and partial reduction is brought about, the final reactions taking place in the crucible of the furnace. The limestone in falling is burnt to lime by the time it has reached the crucible. This of course means the addition of carbon dioxide to the gases, and in consequence makes the reducing efficiency of the gases less; but the result has not been found to interfere seriously with the process.

It can readily be seen that fine Canadian magnetites are especially adapted for use in this form of furnace. It has been found that in many cases it is not necessary to even concentrate these ores, as the very basic slag that can be used in the electric furnace makes the handling of phosphorus and sulphur easy.

This particular furnace is 300 k.w. capacity, and is operated on three phase current. Only one electrode is shown in the cut. Actually there are three, situated at equal intervals around the furnace and dipping into the crucible at about 60 degress to the horizontal. The transformer is built to give a range of voltage from 56 to 84 volts, as required. Hand regulation of the position of the electrodes is used, there being no difficulty experienced in this respect as very even running conditions are obtained. The electrodes are 5⅛ in. graphite and pass through water coolers in the roof.

As would be expected, the metal resulting from this furnace is very sound, this, of course, being a characteristic common to all electric furnace steel. In connection with the work on the furnace, the writer has made a series of tests of the steel with the following results:

Results of Tests on Electric Furnace Steel.

		Natural Specimen.			Heat Refined.		
Heat.	Carbon.	Elastic limit.	Ultimate strength.	Per cent. Elonga'n in 2 ins.	Elastic. limit.	Ultimate. strength.	Per cent. Elonga'n in 2 ins.
167	.23	53,300	68,950	12.5	52,300	72,100	26.25
167	.18	47,500	63,900	15	46,300	66,850	25
171	.31	56,000	82,800	12.5	53,000	84,500	22.5
175	.12	49,200	53,700	17.5	47,050	57,450	35
178	.23	52,500	68,750	13.75	53,600	70,500	27.5
181	.35	53,300	84,600	10	53,950	88,400	20
184	.21	59,450	80,050	15	59,200	81,500	22.5
187	.29	49,950	74,850	15	50,500	76,650	30

The effect of heat refining is very marked, as indicated by the gain in ductility.

It is of great interest to note that the steel obtained is very fluid, which, of course, when used for steel castings, gave very clean surfaces, such as are ordinarily obtained only in grey iron castings. In fact, it was difficult to convince some users that such was not the case without actually breaking the castings and noting the ductility and fracture.

MANGANESE STEEL*

By W. S. Potter, Pittsburg, Pa.

The proportions of manganese and carbon in manganese steel are familiar to all, because manganese steel castings have been well known for a decade or more in this country. The same alloy has now become a commercial product in the wrought state, and, as not only rails and bars are rolled daily but a great variety of forged and otherwise fabricated shapes are appearing, it may be interesting to mark the progress and, perhaps, to look a little closely into the nature of this important material of engineering.

Accordingly, this paper sets forth briefly the results of a few tests and experiments and endeavors to connect the retardations, for the most part slight, observable in heating and cooling curves, with changes in microstructures seen after various heat treatments of the metal, and to correlate these with physical tests.

Retardations in Heating and Cooling.

Concerning heating and cooling curves, it should be noted at the outset that when the steel has once been so treated that it has a uniform austenitic structure, it may be heated and cooled either slowly or rapidly between, say, 0° C. and its melting temperature (ordinarily at between 1,350° C. and 1,375° C.) and the retardations observable are slight and without many repetitions. They might well be attributed to vibration or error of instruments. Specimens taken from small castings, and also rolled or forged pieces, generally show but slight retardations.

However, when the metal is first slowly frozen, and then slowly cooled—for example, at the rate of cooling prevailing in the interior of even a small mill size ingot—the retardations are much sharper and greater. As the manganese and carbon percentages are raised, the seperable constituents are increased, also by slower freezing, and cooling, the separations are increased. With greater separations the retardations are naturally greater.

The structural constituents of the series of metals from 9 to 20 p.c. manganese, and from 1 to 2 per cent. carbon (probably also of alloys considerably outside this range) are gamma iron, or austenite; cementite, a double carbide of manganese and iron; a eutectic of cementite and austenite; and what appears to be a second eutectic of lamellar structure. Structures which have the appearance of martensite, troostite, and sorbite are also found in their proper relative positions. In cooling from the liquid, gamma freezes out as excess. Next, the lamellar eutectic freezes, although it is possible that the lamellar arrangement is due to mechanical break-up slightly below the end of freezing. Lastly, the residual liquid mixture of cementite and gamma iron freezes—this eutectic is white and is usually in part, or wholly, surrounded by the lamellar eutectic, although it sometimes appears within the austenite as a nodule from which the cementite radiates. As the temperature falls below 825° there is a separation of the cementite from the austenite, giving rise to a variety of patterns, some decidedly martensitic. Troosite, and apparently sorbite, similarly result from the breaking down of the austenite as the temperature still further falls. On account of the very considerable difference in magnetic effects obtainable by cooling through, or heating in, different temperature ranges, it may be that the carbides separating in cooling at about 550° C., for instance, may not have the same composition as those separating in martensitic form at 825° C., or those separating as cementite plates at about 1,250° C. In the reheated steel during slow cooling, between 1,300° and 1,200° C., cementite separates out of the austenite as plates and needles radiating from a central nodule.

Conclusions from Heating and Cooling Curves.

The results of heatings and coolings show:

1. That there is usually a well-defined retardation between 850° and 870° C., on heating, with corresponding retardation at 850° to 825° C., on cooling.

2. That a retardation at 1,100° to 1,140° C. on heating is slight or well-defined, according to the composition of the alloy, and corresponds to a retardation on cooling at 1,125° to 1,060° C., which is equally dependent upon composition.

3. That another retardation on heating at 1,200° to 1,210° C., which is also slight or well-defined according to the analysis, may correspond to slight retardations recorded during cooling, at 1,200° to 1,170° C.

4. That the retardation due to melting occurs at 1,350° to 1,375° C., and even lower with some alloys, while the retardations due to freezing occur at 1,370° to 1,320° C., and 1,300° to 1,275° C., respectively.

5. And, finally, that slight retardations on heating were recorded at the following temperatures, in degrees C.; 350 to 375; 450 to 470; 575; 675 to 735; 975 to 1,025; and, on cooling, at the following temperatures, in degrees C.: 1,010 to 1,030; 925 to 950; 650 to 710; 525 to 550; 420 to 450; 325 to 350.

Conclusions as to the Metallography of Manganese Steel.

I present the following as fairly well proved points for further observation: In steel containing 10 to 20 per cent. manganese, 1 to 2 per cent. carbon, during cooling, gamma iron begins to freeze at about 1,370° and is for the most part frozen at about 1,270° C.; the eutectic freezes at 1,125° to 1,080° C., or perhaps a little higher temperature with low carbon and manganese mixtures; the mechanical break-up of austenite begins at 850° to 825° C.; carbides separate between the grains at 710° to 650° C.; the magnetism increases at 550° to 525° C., with further carbide separation between the grains, and there is a further mechanical separation at 430° to 420° C.

In heating, if the steel is originally austenitic, there is a preliminary break-up at 350° C.; a further break-up at 450° to 470° C.; and a complete break-up at 575° C., with separation of magnetic carbides of iron or manganese at 475° and 575° C.

In rolled steel: Separated carbides begin to be redissolved at about 725° C., and this is completed at 850° to 870° C., with re-formation of austenite.

Slight re-separation of carbides occurs along the grain outlines as the melting point of the eutectic is approached, beginning at about 1,025° C., and continuing to 1,100° C., or over. This is most noticeable in ingot metal, and taken together with the fact that the outlines of the original freezing structures persist in the cast steel at temperatures below 1,125° C. or thereabout, the remarkable tenderness of ingots between 1,025° and 1,125° C. is made clear.

In cast ingot metal: The melting of the eutectic occurs at 1,120° to 1,140° C. if heating is slow, and at about 1,100° to 1,130 C. if heating up to this point is rapid; complete resolution of constituents and re-formation of uniform austenite grains take place above 1,150° C.; cementite re-separates extensively above 1,250° C.; the mass melts at 1,350° to 1,375° C., or lower, depending on its composition.

*Extracts from a paper presented at New York Meeting A.I.M.E., February, 1914.

THE PRESENT STATUS OF OXYGEN BREATHING APPARATUS

By F. W. Gray.

A report on self-contained breathing apparatus, which has been made to the Doncaster (Yorkshire) Coal-owners' Committee on Gob Fire Research, by Dr. J. S. Haldane, has given rise to sharp comment in the editorials of the English trade papers. The editorial in one of the best known of these papers was headed "The Failure of Rescue Apparatus," a title that on mature consideration most fair-minded persons connected with coal-mining, will conclude to be a trifle spiteful. In the first place there is not, or should not, be any contrivance known as a "rescue apparatus," and if, as is the case, the reference is to self-contained oxygen breathing apparatus, it cannot truthfully be said that these devices have been a "failure."

The truth of the matter is that mining engineers on the other side of the Atlantic share the usual British dislike of grandmotherly legislation and compulsion, and a good deal of the criticism levelled against oxygen breathing apparatus has arisen from a feeling among mining engineers in Great Britain that the provisions of the Mines (Rescue and Aid) Act were impracticable and hastily conceived. Other enactments, such as the Minimum Wage Act, the Eight Hours Act, and the new Coal Mines Regulation Act, have irritated and greatly added to the worries and work of those who direct the coal-mining industry in Great Britain, and for some time past the trade papers and the presidential addresses given before the mining societies have been almost monotonously insistent on the growth of red-tapeism and restrictive legislation bearing on the working of coal mines. The response to Dr. Haldane's strictures on oxygen breathing apparatus, and the ready assent his findings have met with among colliery managers and colliery owners, is therefore, not so much caused by a feeling that breathing apparatus are a "failure," as by a feeling among those who are trying to work out this and other problems of coal-mining that the Mines Department of the British Home Office has been shown to have been guilty of hasty and ill-considered action in compelling the provision of breathing apparatus at all coal mines, and in encouraging a sympathetic, but uninformed public, to look for wholesale rescue of life at or after a large catastrophe.

Oxygen breathing apparatus has been placed in the difficult and false position of being required to live up to the reputation of a "rescue" apparatus, when really its proper function is that of an adjunct, a useful auxiliary, to the underground fire brigade. As a means of fighting underground fires at close range, the usefulness of oxygen breathing apparatus should surely by this time be unquestioned. It would be difficult to name a coalfield of any importance, where they have not been so employed with advantage, and they have also been found very useful in metal, ironstone and sulphur mines.

It is too soon to say that oxygen apparatus is a "failure." If Dr. Haldane's report proves anything it is that these devices are capable of improvement, and are in process of evolution through the processes of trial and experience. The fact that the Doncaster Coal-owners' Committee propose to ask Dr. Haldane to make a further test at the end of three months, in order to see if the apparatus on the market at that time has been improved, is in itself sufficient proof that the Committee do not consider the objections raised as being fatal, or that the present apparatus on the market cannot be raised to the required standard.

Much has been said of the number of lives lost through wearing breathing apparatus, and it is right that this point should not be glossed over. Some of these deaths have revealed unsuspected possibilities of danger in the use of breathing apparatus, but some others have resulted from the use of defective apparatus.

The men who have used breathing apparatus, have, like the apparatus itself, suffered from the false perspective in which they have been placed. In compelling the provision of breathing apparatus, and the training of men in its use, the Home Office do not seem to have considered that men who take training thereby single themselves out for dangerous duties, and lay themselves open to the unjust imputation of cowardice, if they should refuse for the best of reasons to undertake impossible tasks of rescue when the time of testing arrives. It says a great deal for the courage and heroism of miners, that they have not hesitated to avail themselves of the help that breathing apparatus has afforded, and it may be pointed out that the work of rescue after mine disasters, with or without the aids of modern invention, has always, and always will, take death toll of brave men, who are prepared to risk anything to save their comrades. And for this very reason a sharp distinction must always be drawn between the use of breathing apparatus in the minor accidents of a mine, such as accumulations of gas, fires and other temporary derangements in which breathing apparatus are useful, and their use after great disasters.

Dr. Haldane states that his experience has not been sufficient to say, "How much difficulty is found in keeping each apparatus fit for use and applying the necessary tests, or to what extent proper precautions are actually taken." This is probably the most important point in connection with the use of breathing apparatus. Although Dr. Haldane is very impartial in pointing out serious defects in every single type of breathing apparatus on the market, and although several men have lost their lives when wearing these devices, a good many instances could be given of the actual use of breathing apparatus for very long periods, under exacting conditions, without any such happenings, and there can be no question that several of the apparatus on the market, when in good order and used by experienced men, will enable the safe performance of strenuous labor in an irrespirable atmosphere, and have done so on very many authenticated occasions. But apparatus must be in good order. No amount of ingenuity or skill in devising a flawless and physiologically perfect apparatus will prevent accidents, if these apparatus are not kept in good order and tested before use. In an article that appeared in this journal shortly before Dr. Haldane's findings were made public, the writer likened the wearer of a breathing apparatus to an aviator and suggested that equal care in testing and inspection was necessary in

the use of breathing apparatus under dangerous conditions as in the use of an aeroplane. Dr. Haldane uses the same illustration, and remarks: "Liability to failure of some essential part of a rescue apparatus would, in fact, be nearly as dangerous as similar liability to failure in an aeroplane."

It must also be remembered that the sole object of breathing apparatus is to enable men to live and work in an irrespirable atmosphere, such as exists under certain conditions in mines, more particularly coal mines. The apparatus worn for this purpose is no protection against the other dangers of the mine, and it will not enable a man to penetrate where it would be difficult, in a pure atmosphere, for an unencumbered man to penetrate.

The condition of the underground workings of a coal mine after an explosion is usually much disturbed, the interruption very often occurring at some important junction or entrance, fire is often present, and in all the recent great coal mine explosions, the death of those underground seems to have been simultaneous with the blast, or to have occurred very shortly after. It is unfortunately only too true that the prospect of rescuing any great number of men after an explosion in a modern coal mine, is of the slimest description, and the work of the apparatus men is usually the melancholy one of bringing out the dead. The sooner the public mind is disabused of the idea that breathing apparatus add to the safety of a mine, or will enable the performance of miracles in rescuing men, the better. The function of these apparatus will then be seen in the true perspective, and they will be valued for what they are, namely first, a useful auxiliary in circumstances that occasionally arise in a coal mine, more particularly in fighting and sealing off mine fires; and second, for assisting in the restoration of ventilation, the advance exploration, and the removal of the dead after a mine explosion.

With these objects in view, by experience and candid scientific investigation such as that undertaken by Dr. Haldane, there can be little doubt that the evolution of the breathing apparatus will proceed from good to better, as it has done in the past. In the meantime, it might be suggested to makers of these apparatus that a little less "knocking" of the other fellow's device, and attention to some of the defects pointed out by Dr. Haldane's report would be well received by those who have to believe or disbelieve the irreconcilable statements of rival makers.

N. S. STEEL AND COAL.

Profits of the Nova Scotia Steel and Coal Co. showed considerable improvement in 1913 over 1912. The year's income of $1,255,953 represents a gain of $255,944 over the previous year. Earnings, after meeting all fixed charges, and providing for depreciation and betterments, were equal to 7.80 per cent. on the outstanding $6,000,000 of common stock. This compares with a net of 5.67 earned in 1912, when, however, it will be remembered the company suffered materially from American "dumping."

After meeting all charges, which showed an increase due to the issue during 1913 of $2,000,000 debenture stock, the company carried forward $75,286 out of the year's earnings. This together with the balance at December 31, 1912, of $452,600 brings the total amount carried forward to $527,886.

Profit and Loss.

The profit and loss figures of the past three years make the following comparison:

	1913.	1912.	1911.
Profits	$1,235,953	$1,000,609	$1,019,392
Less—			
Bond interest	395,576	352,311	291,168
Debenture interest	109,559	60,000	60,000
Sinking fund	32,659	26,105	24,800
Depreciation Reserve	70,185	92,196	96,124
Written off	107,682	61,009	73,880
Directors	12,500	12,500	12,500
Insurance fund	10,104	10,032	10,576
Total	$738,267	$614,153	$569,048
Balance before div.	517,686	368,456	450,344
Less—			
Preferred dividend	82,400	82,400	82,400
Common dividend	360,000	360,000	360,000
Total dividend	$442,400	$442,400	$442,400
Net balance	75,286	*55,944	7,941
Previous balance	452,600	508,544	500,603
Total balance	$527,886	452,600	$508,544

*Deficit.

General Manager's Report.

In a report placed before the directors at a meeting in Montreal, Thomas Cantley, general manager, stated that 1913 had opened with great promise. Demand for the company's products during the early part of the year had been good. During this period a large tonnage was booked at fair prices, sufficient to keep the mills fully employed until the closing weeks of the year, the result being that the outputs of iron ore, pig iron, steel ingots, billets, bars and forgings all showed substantial increases over previous years.

Referring to the Wabana iron ore property the report stated that the company's holdings under title from the Crown now covered 91 square miles, and that the submarine development had been extended by the opening up of 9,751 linear feet of levels, crosscuts, headways and rooms, and the ore won from this section of the property was over 40 per cent. greater than that of the previous year. The general manager also reported that good progress had been made in the sinking of the new Jubilee shaft, which would be equipped by 1915 for an output of 1,500 tons per day. A new open-hearth steel furnace was completed during the summer, and a number of improvements to plant and equipment had been carried out.

Perhaps the one point lacking in the very excellent report returned by Mr. Cantley and the directors in preparation for the shareholders' meeting is that no indication is given of the possibilities for 1914. No forecast appears with regard to the outlook for business as viewed by the directors. The company is seen to be in a very strong financial position, but at a time when so many vague and not altogether favorable reports are heard on the "street" with regard to the steel industry, it would be interesting and no doubt more reassuring to hear how the directors regard the possibilities for business in the coming months. Possibly the shareholders will hear something of 1914's prospects at the annual meeting, which takes place in March.—Financial Times, Montreal.

PLACER MINING IN THE KLONDIKE*

By D. D. Cairnes.

In a few localities, as on Quartz creek, along the lower portion of Sulphur creek, and on a few outlying creeks, private parties are working their properties with small outfits, and there, the old-time methods, formerly so extensively employed are still to be seen. Throughout the greater part of the district, however, the placer deposits are owned and operated by large companies or corporations who work their holdings on an extensive scale. The larger companies are the Yukon Gold Company, Boyle's Concession Limited, and a company controlled by Mr. A. N. C. Treadgold. These companies control the bulk of the placer property in Klondike district, and in attempting to give a general description of the placer mining operations in Klondike district, possibly the best and simplest manner of so doing will be to describe briefly the installation and work of each of these companies.

In mining in this district many changes were necessarily introduced in adapting to the frozen gravels of Yukon the placer mining methods previously understood and employed in California and other temperate climates. The dredges had to be strongly built in order to withstand the severe service of digging the broken schists which compose the bedrock, and the frozen gravel which is almost impenetrable as granite. Probably the most serious problem, however, was to overcome the frozen condition so that the material could be handled as readily as similar ground in California or elsewhere. These matters are of intense interest to the mining engineer.

The Yukon Gold Company.

The Yukon Gold Company owns practically all the more important gravels on Bonanza, Eldorado and Hunker creeks and their tributaries, the holdings of the company being mainly included in an area about 25 miles in diameter.

The operations of the Yukon Gold Company in Klondike district are in general, limited to two phases of placer mining, viz., dredging and hydraulicking. The gravels in the valley bottoms are all dredged, but those higher up on the hills and sidehills, which cannot be conveniently reached by the dredges, are hydraulicked, and in general the lower deposits are first worked so as to afford tailings ground when working the higher gravels. During the season of 1912 an average of about 600 men were employed by this company, 400 of whom were engaged in connection with dredging, about 130 on the hydraulic properties and ditches supplying these with water, and the rest were employed mainly in the machine shops, power plant and stables.

Dredging.

The Yukon Gold Company has built and is operating eight dredges, as follows:—Three Bucyrus 5-foot boats, one Marion 7-foot boat, four Bucyrus 7-foot boats.

The 5-foot and 7-foot boats have buckets with a capacity of 5 and 7 cubic feet respectively. All are electrically driven, elevated, close-connected bucket-line dredges of the revolving screen and stacker type. Two of the boats, numbers 8 and 9, which were built during 1911, have hulls constructed entirely of steel.

The dredging season opens about May 1st and the dredges can operate from then until some time between October 15th and November 1st, an average of about 175 days each year.

The capacity of the dredges on the creeks in which they are working, has proved to be about 100,000 and 120,000 cubic yards per month for the 5-foot and 7-foot boats respectively. The area they cover depends largely on the depth of the ground in which they are working. During 1912, however, the 5-foot boats covered, on an average, about 12,000 square yards, and the 7-foot boats an average of about 16,500 square yards per month. The dredges run day and night, and shut down only for repairs or to clean up, the latter being necessary about every 3 to 9 days.

The ground to be dredged is all previously thawed. In some areas, as in the neighborhood of a creek, or where the moss has in some way become stripped off the surface, the ground has become naturally thawed. In places, also, the gravels have been thawed during former mining operations, but the greater part of the ground is thawed by steam just previous to dredging. Long, hollow, perforated steel tubes with sharpened points are driven into the ground, and steam is forced through these and into the surrounding frozen ground.

The dredges take up, in addition to the gravels and overburden, the underlying bed rock to a depth of 3 to 9 feet.

The Giant Ditch.

In connection with the hydraulic operations of the Yukon Gold Company, one of the greatest problems was that of obtaining sufficient water to work the properties. To obtain this water a giant ditch system has been constructed and a storage dam built.

The storage dam, situated on Upper Bonanza creek, is 68 feet high at the crest, 205 feet wide at the base, and 465 feet long at the top, with an impounding capacity of 54,000,000 gallons.

The main ditch conveys water from Little Twelvemile river to the creeks of the Klondike district. The main ditch system consists of 64.2 miles of main line, composed of 15 miles of flume, 37 miles of ditch, and 12 miles of pipe line, crossing five depressions and delivering water to the Lower Bonanza hills under a head of 500 feet. The capacity of the main ditch is 5,000 miner's inches. The Bonanza Extension is approximately 6 miles in length, has a capacity of 3,000 miner's inches and crosses three depressions. The total length of the ditch system and extensions is 75.2 miles.

Practically the entire construction work of the Yukon Gold Company, including the ditch system, was completed in three seasons of four months each, or a little over one year of actual construction work. Considering the unusual difficulties to be overcome, this work may be justly called an engineering triumph. The Klondike syphon—the huge pipe line which carries the water across the valley of the Klondike—was itself an undertaking of considerable magnitude. Mr. T. A. Rickard in his description of this ditch system writes: "The country traversed by this ditch is a rolling woodland indented by the alluvial flats of the Klondike, the Twelvemile, and other streams flowing into the Yukon

*Extract from guide book No. 10, prepared for the 12th session International Geological Congress, by the Geological Survey, Canada.

river. As seen from a height, the wilderness stretches unbroken from the meandering shimmer of the Klondike, enclosed within high banks on which white scars mark bench-diggings, to the Ogilvie range, where, far to the north, the snow still lingers in token of the gift of water that shall enable man to win the gold from the deposits of gravel strewing the tortuous valleys."

In preparing to build the ditch, the first step was to place a sawmill on Twelvemile river, and thus to obtain the lumber for construction. Then an electric generating plant was erected and the wires were strung on poles for 36 miles, transmitting power from Little Twelvemile river to Bonanza creek. While this was being done, surveys for the ditch were hastened; and as soon as these were completed, the right-of-way was cleared. The small growth of forest was removed, and the moss stripped from the frozen ground for a width of 22 yards. Steam shovels were then put to work, and while the ditch was being dug, the sawmill on the Twelvemile yielded the lumber needed for the construction of the flume and for other purposes. Seven million feet (board measure) of lumber was cut; this depleted the small forest in the vicinity, but it proved sufficient.

In connection with building the ditch, "roads of the corduroy type have been constructed, moss being laid on the poles and dirt on the moss. The trails traverse the brush in straight lines. Horses and men, steam and muscle, have fought against the wilderness and subdued it. The big ditch looks like a Panama canal, and the steam-shovels gnawing and digging in the deep cuts recall pictures of Culebra. Many of the laborers had worked on the Isthmian canal, and assuredly the young engineers were as proud of the work they were accomplishing as if it were a national or even an international enterprise."

About 14 hydraulic properties were operated in 1912 on the different hills and gulches along Bonanza and Hunker creeks, the majority of these being on Bonanza creek below Grand Forks. These hydraulic properties are equipped with auxiliary pipe lines from the main water system, gates, tunnels, cuts, sluiceways, and giants from which the streams of water are driven with a pressure of upward of 100 pounds to the inch, and strike the banks with a roar that can be heard for miles.

The company's hydro-electric power plant is operated by water from Little Twelvemile river carried through 5 miles of flume and delivered to the plant under 650 feet net effective head. The installation consists of three 650 K.W. generators, direct connected to the three water wheels of the impulse type. The main transmission here is 36 miles in length, operating at 35,000 volts with 18.2 miles of extensions and secondaries.

Boyle Concession, Limited.

The Boyle Concession, Limited, has taken over the holdings of the Canadian Klondike Mining Company; controls and operates the properties of the Bonanza Basin Gold Dredging Co.; and operates the plant of the Granville Power Company.

The holdings of the Boyle Concession, Limited, include the Boyle Concession, about 4 miles of the creek bed of Allgold creek, and 4 miles of the creek bottom of Flat creek. The Boyle Concession comprises 6.7 miles of the valley of Klondike river to the summits on either side, also Bear creek and its hillsides, and the Klondike river slope of Lovitt hill; in all about 40 square miles. The holdings of the Bonanza Basin Gold Dredging Co. include about 50 placer claims in a group at the lower end of Klondike River valley and just below the Boyle Concession; nearly all Last Chance creek with adjoining hillsides; part of Dago hill; a number of placer claims on the upper end of Hunker creek; and some placer claims on Upper Eldorado.

The operations of the Boyle Concession, Limited, are confined at present to dredging. Two dredges were in operation in 1912, and two more were being built.

No. 1 dredge is an electrically driven boat, with a close-connected bucket-line of 68 buckets, each having a capacity of 7½ cubic feet. This dredge has a total motor capacity of 350 horsepower and has been operating continuously each season since 1905. No. 2 dredge is an electrically driven boat with close-connected bucket-line of 68 buckets, each having a capacity of 16.1 cubic feet. This dredge has a total motor capacity of 1005 horsepower, and started operating in 1910 and has since operated continuously during the dredging seasons.

These two dredges are both operating in the valley of the Klondike on the Boyle Concession.

The two dredges being erected will be very similar to No. 2, but will have slightly larger hulls and will be equipped with some new features for protection in operating during severe weather. Each boat contains over 1,000 tons of machinery and required 612,000 feet of lumber in the building. These are being erected on the property of the Bonanza Basin Gold Dredging Co., below the Boyle Concession.

The Boyle Concession, Limited, has a machine shop capable of making all repairs at the mouth of Bear creek, and also owns three 35-ton steam shovels with hauling equipment, and other machinery.

The Granville Power Company has a 10,000 horsepower hydro-electric power plant situated in the valley of Klondike river near the mouth of the North fork. The water is taken from the North fork of Klondike river through 6 miles of ditch having a capacity of 15,000 to 20,000 miner's inches, and is supplied to two turbines through two pipes with an effective head of 228 feet.

The power plant consists of two units, and includes two I. P. Morris 5,000 horsepower wheels of the reactionary type, two alternating current generators and two excitors built by Westinghouse Electric Manufacturing Co. The power is generated at 2,200 volts and stepped up at plant to 33,000 volts, and is carried over two main distributing lines, one down Klondike river to its mouth, and the other across the divide to the Indian River watershed.

This plant ran until December 21st, 1911, and the company hopes to be able to instal devices enabling them to operate throughout the entire winter.

Treadgold Property.

A company managed by Mr. A. N. C. Treadgold holds extensive interests mainly on the Indian river side of the divide. This company controls practically all Dominion creek; has interests on Sulphur creek; controls most of Quartz creek and Indian river below Quartz creek; and also has a few claims on the upper end of Eldorado creek. During 1912 the operations of this company were mainly confined to Dominion creek, where they did only preliminary work. This consisted mainly in removing the overburden by ground sluicing and so preparing the ground for future development.

Placer Gold Production of the Yukon.

The placer gold production of the Yukon from 1897 is as follows:—

1898	$10,000,000
1899	16,000,000
1900	22,275,000
1901	18,000,000
1902	14,500,000
1903	12,250,000
1904	10,500,000
1905	7,876,000
1906	5,600,000
1907	3,150,000
1908	3,600,000
1909	3,960,000
1910	4,550,000
1911	4,580,000
1912	5,540,000

The low production during 1907, 1908 and 1909, was due mainly to the fact that at that period placer mining was undergoing a transition from the old to the new methods. The Yukon Gold Company had acquired most of the ground that had formerly been the most productive, and were devoting their energies to installing their new equipment rather than to mining.

The figures given above are for the entire Yukon Territory, but the gold production from points outside of the Klondike has probably never exceeded $100,000 per year.

BRITISH COLUMBIA COPPER CO.

The following information relative to the British Columbia Copper Co., Ltd., has been printed in Western Canadian newspapers and other publications:

Official announcement received from New York states that Hayden & Stone, Boston and New York bankers, have consented to underwrite the proposed $1,000.000 bond issue of the British Columbia Copper Co., and as a result the stock jumped to $4.00 a share on the eastern exchanges, an advance of $2.00 in ten days. The company is to be reorganized under terms agreed upon by present stockholders, who assert that the conditions imposed are not fair and equitable, but such that the company will be enabled to consummate the plans for expansion and development it has had under consideration for years.

"As for its Mother Lode and other mines British Columbia Copper Co. has been operating at a profit for many years," says the report. "These have been steady income producers, but, unfortunately, the earnings have been expended the last two years in acquiring and exploring a number of new properties in Washington and British Columbia. In the last 18 months the company has spent approximately $550,000 in purchasing and developing new holdings. In the last two years the net earnings have been not to exceed $700.-000, and it can be seen readily that this campaign of expansion entailed a heavier financial burden than the company could carry conveniently, in view of its limited resources, and the result was the depreciation of its stock from $8 a share a few years ago to a low level of $2.

Will be Reorganized.

"Hayden, Stone & Co. have underwritten a proposed bond issue of $1,000,000 in convertible 6 per cent. debentures. The matter of issuing these bonds, as well as other detail of refinancing the company, will be submitted to stockholders, and afterward a special meeting will be called, when the proposals doubtless will be ratified."

While the proposed plans have not yet been given out, it is learned that the British Columbia Copper Co., now capitalized at $3,000,000, will be reorganized into a $5,000,000 company. Of the 1,100,000 shares of new stock, par $5,600,000 shares will be set aside to arrange for exchange, share for share at par, of the present stock for the new stock. Two hundred thousand shares of the new stock, of the value of $1,000,000, will be placed in the treasury as a reserve against conversion of the $1.000,000 of 6 per cent. convertible bonds to be issued. It is inferred that the remaining 200.000 shares of the new stock, left in the treasury, will be used or sold for company purposes in acquiring, developing and equipping new properties. As a matter of fact, the present outstanding shares of British Columbia Copper Co. total only 591,709, instead of the authorized 600,000, so that under the scheme of reorganization there will remain "treasury stock" amounting to 208.291 shares of the par value of $5 each, instead of 200,000 shares.

New Properties.

The principal new properties to be taken over by the British Columbia Copper Co. are the Princess group, of between 40 and 50 claims, situated on the flanks of Copper mountain, in Voigt's camp, Similkameen, British Columbia. Thirteen of these claims had been taken up by the company in 1912. The ore already blocked out in this tract is 4.000.000 tons of ore, averaging 1.87 per cent. copper, and there is estimated to be 4.000.000 tons of probable ore not yet blocked out. The ores carry 60 cents a ton in gold and silver. It is proposed to erect a concentrator to handle the product from the Copper Mountain group, but the main smelter of the company at Greenwood, Boundary district, British Columbia, will smelt the concentrates. The company's engineers have already selected a power site, which will be used to develop hydro-electric power in connection with the new mines. This power site is on Whipsaw creek, a tributary of Similkameen river, opposite Copper mountain, and about 10 miles from Princeton.

Mines in Washington.

Another property of the British Columbia Copper Co. which is giving considerable satisfaction is the Lone Star and Washington group, just across the International boundary line, and about eight miles south of the company's smeltery at Greenwood. Nearly 500.000 tons of ore have been developed within less than 10 per cent. of the Lone Star ground in the last few years, and further development is now in progress. The ore is of a somewhat refractory nature, and a concentrating plant has been installed near the Dominion Copper Co.'s works at Boundary Falls, three miles from the British Columbia Copper Co.'s plant at Greenwood. At this concentrator the refractory constituents of the ore will be eliminated. A five-and-a-half-mile aerial cableway connects the Lone Star mine, running cross country to the concentrator.

Another property taken under option by the British Columbia Copper Co. is the Eureka group of claims near Nelson. The third payment on the option for this group was made several months ago. The company also recently put men at work on its properties in Wellington camp, purchased in 1909.

COMPARISON OF MINING CONDITIONS IN THE UNITED STATES TO-DAY WITH THOSE OF 1872*

By R. W. Raymond.

The situation in 1872, from the standpoint of the prospector, the locator, the possessory claimant, and the patentee of mineral land under Federal statutes, cannot be understood without a knowledge of the situation prior to 1866, and between 1866 and 1872.

The Situation Before 1866.

The western public domain acquired by the United States through treaties, as the result of conquest or purchase, was invaded after Marshall's re-discovery of gold in California, by an overwhelming multitude of prospectors and miners from all parts of the world. The mineral lands of the whole Pacific slope were practically unsurveyed. Congress, disgusted with the experiment of leasing mineral lands, which it had tried for 40 years, and abandoned in 1847, enacted no laws for the management of these public mineral lands, and the pioneers made their own laws governing mining titles. These local regulations applied at first to gulch-mining in the auriferous river beds only; and they constituted a simple and practical system, adapted to the needs and means of primitive communities—significantly called "camps." They had the means of measuring distances, but not angles; they knew no property except personal property in the form of pick-axes, pans, supplies, camp-equipage, horses or mules, and mining rights. The earliest codes which they developed expressed what might be called the law of the lariat. With the lariat they measured the distance assigned to each miner along the gold-bearing gulch—a double portion to the discoverer, and a single portion to his successors, in the order of their coming. With the lariat, they hung, after such due process of law as was available, the rascal who stole a horse, or a bag of gold-dust, or a mining claim, or killed another man without giving him fair notice and a chance to defend himself. In these pioneer codes, adopted in mass-meetings and enforced by the same authority, two features concern us most:

1. They measured mining property by one dimension only. So many feet of the gulch, held by one man, meant a distance into either bank, and a distance in depth, extending as far as gold might be found.

2. Priority of right (and usually double extent of longitudinal dimension) was given to the discoverer, and, after him, to locators, in the order of location.

This system of mining titles ignored altogether the superior rights of the United States as owner of the land. As I have elsewhere shown,† this difficulty was solved by the common sense of the courts, which adjudicated controversies between trespassers on the public domain, according to their relative rights under local regulations, and subject to any future assertion of the higher rights of the United States.

Meanwhile, in many districts, the discovery of metal-bearing veins had inaugurated the new industry of "quartz-mining," and the pioneers simply applied to these deposits the rule already adopted for gold-bearing gulches: namely, they treated a vein as if it were a gulch; granted mining claims upon it, measured by a single dimension, and included in each claim all "dips, spurs, and angles," i.e., all valuable mineral branching from the main vein between the two ends of the claim.

The Situation Between 1866 and 1872.

The Act of 1866 was an attempt to legalize the conditions which had thus grown up in the absence of Federal legislation. It declared the public mineral lands open to occupation and exploration, thus removing the guilt of trespass from prospectors and miners, and permitting for an indefinite period the exploitation of such lands, under the local regulations of the mining camps of the States or Territories in which they were situated. This confirmed the prior right of the discovery, which was the basis of all such local regulations. Moreover, the Act adopted the "law of the lariat, "that is, the measurement of mining claims by one longitudinal dimension, and the possessory title of the locator to "dips, spurs and angles." Finally, it provided for the purchase of permanent rights by patents from the United States, including certain rights within a given area of surface, required for mining operations on the vein located. This area was to be defined before the grant of the patent.

But unfortunately the Act of 1866 did not grant to locator or patentee any exclusive possession of the surface thus located, but only an "easement," or prior right of use. I believe that this feature of the Act, like the rest of it, was simply intended to legalize existing mining conditions, especially at Virginia City, Nev., which was, in 1866, the most productive locality of "quartz-mining" in the West. The towns of Virginia City and Gold Hill were situated on and along the outcrop of what came to be known afterward as the great Comstock lode, though separate mines were then operated upon what were asserted to be separate lodes. The valuable buildings and building-lots of these towns would have been included in any grant of the surface to the mine-owners; and the Act was so drawn as to give the mine-owners only a sort of right of eminent domain, by virtue of which they could occupy such ground as they needed for mining purposes. Whoever saw the Comstock mines of that period, must remember the amazing complex of dumps, ore-bins, roads, shaft-houses, derricks and whims, interspersed with hotels, saloons, offices, stores and residences, exhibited at Virginia City.

But in the other mining districts which were soon discovered and developed, with a sanguine enthusiasm kindled by the wonderful bonanzas of the Comstock, the mere "easement" granted to the surface of a mining location was soon found to be an unsatisfactory protection to the locator. One of the most important of these districts—and the one which, I think, had most influence in bringing about the Act of 1872—was that of Reese river, in Nevada, which was characterized by numerous sharply defined, narrow, frequently faulted fissure-veins, carrying very rich silver-ores, such as horn-silver, ruby-silver, etc. The locator upon such a vein had hard work, at best, to prove its identity in depth, beyond a fault which had cut it off, and thrown it to one side or the other. And he could not prevent other adventurers from starting shafts or tunnels in his neighborhood, and claiming as their own any bunch of rich ore that they might find. His only way to establish ownership was to push his own work underground until he reached the workings of such alleged

*A paper presented at New York Meeting A.I.M.E., 1914.
†Our National Resources and Our Federal Government, Trans., xliv 617 et seq. (1912).

discoverers, and then prove a practical continuity of ore from his prior location on the vein. Until that was proved, the hostile adventurers were not trespassers; they were simply exploring the public domain. And after it was proved, perhaps at great expense, he could rarely recover damages for the ore "innocently" taken by them. A writ of ejectment, expelling them from the stopes they had, perhaps, exhausted during the litigation, might be the only fruit of his victory.

This situation, promoting the practice of deliberate robbery in the immediate vicinity of every rich ore body, was, of course, intolerable; and it is not surprising that the Federal court in Lander county, Nev., rendered a decision, so construing the Act of 1866 as to make it authorize a lode-locator to exclude prospectors from the surface of his location. John H. Boalt, the judge who made that decision, was a mining engineer as well as a lawyer, and afterward became one of the leaders of the San Francisco bar. His opinion was acute and forcible. Undoubtedly the Act ought to have meant what he construed it to mean. But his view was overruled by higher authority, though his arguments doubtless had their weight in bringing about the change inaugurated by the Act of 1872.

It is noteworthy that the Act of 1866 did not provide for placer-mining rights, or patents to placer-claims, although this was the earliest mining industry upon the public domain. The reason was that no special difficulty had arisen as to such mining titles. The general permission to explore and occupy the public mineral lands, subject to local regulations, was enough, at that time, to satisfy that class of miners. But in 1870 an Act was passed amending and supplementing that of 1866, by providing that claims usually called placers, "including all forms of deposit except veins of quartz or other rock in place," should be subject to entry and patent. This had two important results: (1) It made placer-claims patentable, as they had not previously been; and (2) it included with placer-claims all deposits not "lodes," and included (as construed subsequently by the courts) other minerals than "gold, cinnabar, silver, or copper" specified in the original Act. There is reason to believe that both of these features, though desirable in themselves, were secured in furtherance of private enterprises—especially that of the so-called "diamond swindle," which was exposed in 1872. At least, I remember that the Act of 1870 formed part of the basis upon which this scheme was presented to New York capitalists.

The Act of 1872 was intended chiefly to remedy the above-mentioned defect in that of 1866, by granting ownership of the surface to a lode-locator. Its authors thought they were grafting a new feature upon the result of long years of growth; but they were, in fact, planting a new root altogether. The Act of 1872 was revolutionary. It made the mining right an appurtenance to the surface location, instead of granting an easement in the surface as an appurtenance of the mining right; for the reward of the discoverer it substituted the luck of the apex-possessor; and the title conveyed under it was subject to doubt and possible defeat as the consequence of new geological discoveries so long as the mining ground which it was supposed to cover might continue to be worked.

The extralateral right, supposed to be simply continued by the Act as a legacy from "the law of the lariat," suffered a considerable change through its dependence upon a new condition—the apex—which might or might not be correctly determinable at the time of location. This sudden introduction of a totally new basis of title led me to call the Act of 1872 "the law of the apex," a name which was universally adopted, together with that of "extralateral right," which I gave to the ownership of certain underground portions of a vein not vertically beneath its surface location. (The term "extralateral" could not have been applied under the Act of 1866, which attached no significance to the shape or position of the location as defining the mining right to which it was a mere appurtenance.) Without going into further details as to the features of either Act, it may be said that both of them were dictated by the desire to respect as far as practicable the customs and self-made rules of miners upon the public domain; and that such changes as were made were intended to meet existing conditions and satisfy the demands of influential constituencies and industries. It is impossible to explain by reference to the provisions of pre-existing European or Spanish-American codes the peculiar features of these statutes. They grew up out of local conditions, and were formulated by men ignorant of precedents and principles. Moreover, even those men were necessarily "opportunists," taking more or less blindly one step at a time. They never had a chance to frame a mineral-land law de novo. From the beginning, they were trying to satisfy the mining communities, and recognize as far as practicable existing local customs, remembering always that any attempt at sudden and essential change of such customs would be ridiculously futile, because incapable of effective enforcement. And of the revolutionary change which was thus made in several respects by the Act of 1872, both the authors of that measure and the communities affected by it were sublimely unconscious.

The foregoing demonstration of the "opportunist" character of Federal land legislation warrants the inquiry whether the conditions of 1872 have since been so changed as to justify new legislation in 1914.

The Situation in 1872.

As I have said, the potential mischief continued in the Act of 1872 was neither foreseen nor immediately realized. The statute was welcomed in the region to which it applied as a much-needed protection to bona fide prospectors and their grantees, the investors of capital. No one expected it to produce a harvest of blackmail and litigation. Its immediate effect was to encourage the adventurous and speculative exploration of one new district after another; and, as the pioneer industry of mining blazed the way for the advance of all other civilized activities (though too often at ruinous cost to itself), the result was the conquest of a vast wilderness, and the creation of a new empire.

The situation in 1872 was this:

1. Indian wars had been practically removed as a serious element of danger, preventing the exploration of the public domain. Their doom was pronounced when the completion of the first transcontinental railway permitted the rapid movement of troops and supplies, so that hostile tribes could be pursued in winter campaigns.

2. Successive discoveries of rich placer or "quartz-mines" were causing excited stampedes of mining prospectors.

3. The price received for silver was such as to encourage silver-mining; and the silver-bearing deposits of such districts as the Cottonwood Canons in Utah, White Pine and Eureka in Nevada, Owyhee in Idaho, etc., were being developed with wild enthusiasm. As we all know, certain classes of silver-bearing deposits offer outcrops of very rich minerals, admirably adapted to stimulate speculation. And the outcrops of silver-lead ores (already utilized in Utah, and soon to assume

at Eureka, Nev., and at Leadville, Colo., immense economic importance) furnished, in their combination of lead, silver and iron oxide, a material "smelting like butter" in the primitive furnaces of the period.

I am not here concerned with the exact dates of successive discoveries and developments in different regions, or successive advances in the mining and metallurgical industry of the West. My own public reports as U. S. Commissioner of Mining, etc., from 1868 to 1876, and many other authorities, may be consulted as to these details. What I wish to emphasize here is the character of the period just before and just after 1872, as one of the new discoveries, new districts, new processes," the exploitation of "bonanzas," and the enormous development of speculative investments in mining enterprises on the Pacific slope. It cannot be denied that the Act of 1872, with all its defects, stimulated this amazing continental development. Carlyle describes the tactics of the armies of the French Revolution as a process of "swarming"—a word which includes, in the German language from which he took it, the element of enthusiasm. The wilderness of our West was similarly overrun by the irresistible "swarming" advance of our mining pioneers, under the stimulus furnished, and in spite of the hindrances imposed (as we can now clearly recognize), by the Act of 1872.

The Present Situation.

The conditions of to-day are the cumulative result of causes operating since 1872, among which the following may be named as the most important:

1. The demonetization of silver and its consequent fall in price. This naturally discouraged speculation in silver-mining, while it promoted economy in mining, handling, and reducing silver-bearing as well as other ores.

2. With the gradual exhaustion of rich bonanzas, the exploitation of large bodies of complex, low-grade ores had many important results.

a. It was both cause and effect of the improvements in the methods and machinery of mining, transportation and metallurgy, mentioned above.

b. It employed larger numbers of men for longer periods, thereby creating greater and more permanent communities, and more numerous and varied industries, trades and institutions. The general working of low-grade ores laid the safe foundation of civilization and progress in the new empire.

c. It brought into profitable use the baser metals, which are more essential to human industry than the so-called precious ones. Yet this development of enterprises in which gold and silver were technically by-products really increased the production of those metals. It is both instructive and amusing to read the utterances of the prophets of the last quarter of the nineteenth century, concerning the future of gold and silver. Our wise predictions were nullified, not so much by the discoveries of new producing districts, as by the new experimental illustration of the old, old general truths, that the existence of a bonanza of very rich ore may, and generally does, indicate the presence of a much larger amount of low-grade stuff, which, being temporarily too poor to "pay," is either not mined at all, or rejected after mining; that the "barren ground" and the waste-dumps of one period may be the mines of the next; and that he who, by utilizing neglected constituents, or reducing costs of mining, etc., enlarges the class of "workable" ores in an old district, may have performed a service equivalent to the discovery of many new ones.

d. This wonderful advance in the exploitation of low-grade ores inevitably diminished to some extent the importance of the old-fashioned "prospector," whose business was to find outcrops, make small surface developments, and sell out to promoters, on the basis of sample-assays. Investors no longer cared so much for " rich" assays; they wanted large masses of low-grade, and a secure title, neither of which the ordinary prospector could guarantee. He become, consequently, more and more a mere scout, whose first discovery was only a call for further investigation by geologists, lawyers, practical engineers, etc., before even the promoter, to say nothing of the actual investor, would take up in earnest the proposed adventure. Moreover, the great mining concerns employed their own scouts, and the old-fashioned prospector, operating on his own account, was almost left out of the new system. He has now well-nigh passed away, as have passed many other free-lances of the vanguard of progress. We may sympathize with him, but he had to go!

3. Legal conditions likewise have been profoundly affected by industrial progress. The ore deposits of greatest importance were very different from the comparatively narrow and well-defined gold veins of California and silver veins of Nevada, which the lawmakers had had chiefly in view; and the provisions of the law were applied with difficulty to the great ore bodies in the "blanket-lodes," "chambers," and "mineral-bearing zones" of Utah, Colorado, and Arizona. Vast sums were squandered in litigation before even the meaning of the terms in the statute defining the extralateral right could be fixed by the U. S. Supreme Court.

Meanwhile, the owners of large mining properties have learned to protect themselves by executing mutual quit-claim deeds or side-line agreements with neighbors, or by purchasing outright such adjoining territory as threatens future conflict of title. In fine, the volume and cost of mining litigation has been greatly reduced, though the expense and difficulty of perfecting title by patent is still too great, and the nature of such title too indefinite. This improvement in the situation, being largely due to the practical abolition of the extralateral right by agreements between neighbors, is an argument rather for the repeal than for the continuance of that feature of the land laws.

Indeed, all the changes in the situation above enumerated seem to me to call for such a repeal, even at this late day. But there is a new factor which may greatly hinder that simple and obvious reform. I refer to the movement for an entirely different treatment of what are called national resources. It seems likely that any attempt to amend the law of the apex will be seized as an occasion for proposing to abolish altogether the system under which, for half a century, the public mineral as well as agricultural lands have been sold to citizens. Present Taft, it is true, in a public address advocating the operation of coal mines and water powers under Federal leases, disclaimed the intention of altering in this respect the laws concerning other mining titles, which he said were working well enough already! But President Taft's limited outlook and moderate suggestions will not satisfy the partisans of the new "nationalism." In my recent paper, cited above, I have discussed this question, and must reserve further statements concerning it, including replies to criticisms of that paper, for another place. I mention it here simply to express my apprehension that the movement for a practicable reform may fail again, as it has failed at

least twice already, through the attempt to accomplish too much. The proposal to change many provisions of the present law (to say nothing of a total change of its purpose—namely, that of transferring the public lands to citizens, and the subsequent control of them to the Territories or States in which they are situated) will have, in my judgment, as it has had already, this result: that the opponents of any one of the proposed changes will unite to oppose them all, and the friends of any one such proposed change will be divided as to some of the others, so that it will prove impossible to make a clear and simple issue, upon which the needed majority could unite. This constitutes an important factor in the consideration of the subject assigned to me by the Chairman of the Institute Committee on Mining Law, at whose request I have written this paper.

VANCOUVER ISLAND LABOR TROUBLES

Victoria, B. C., Feb. 17.—Yesterday was the field day in the Legislative Assembly of the industrial struggle on Vancouver Island.

It was not the first occasion on which the unsettled labor conditions in the coal mining districts have formed the topic of discussion in the Legislature, but the labor difficulties in that section have never before occupied the attention of the Members throughout an entire session.

The Premier, who spoke for more than an hour and a half, devoted a considerable part of his speech to showing that the real cause of the industrial disturbances was not the report of the Gas Committee, as has been alleged by the opponents of the Government, but a determination of the United Mine Workers of America to control the labor situation in the coal mining districts of the Island. The Premier was careful to point out that he had no quarrel with any labor organization, but he taunted the Member for Newcastle and his followers for refusing to come out manfully with the statement as to the real cause of the disturbance, preferring to draw a herring across the trail in the shape of alleged shortcomings of the Government.

The Premier, in resuming the debate upon Mr. Place's resolution of no confidence, regretted the fact that it had been impossible for him to speak immediately after the mover of the resolution, because, he thought, his remarks might then have carried an even greater significance. He was grateful, however, for the opportunity presented to express himself on the subject and made the position of the Government well known throughout the country.

Attitude Towards Labor.

Dealing with the attitude that the Government took in regard to labor, the Premier said he would make the general statement that towards labor in British Columbia the Government had always been fair, and proposed to continue in that attitude. He said that he knew and expected that the Government would be asked from time to time to advance certain legislative measures in regard to labor, and the Government proposed without hesitation to act upon any legitimate suggestions which might be offered. The Government was not a labor Government, but there would never be any disposition on its part to do other than act in a fair-minded manner to all classes of the community.

"The Government wants this to be a workingman's country. We claim it to be a land of opportunity. There is no section of the world to which the worker can come that offers him greater prospects than does the Province of British Columbia. But we are sensible of the fact that when we invite the worker to come here, we must, in the same breath, invite capital to come also. There would be absolutely no point in inviting the workingman to come to this country if we did not at the same time invite the interests of capital; and, successful as we have been in bringing large numbers of workmen to this country, we have not been less successful in bringing capital as well."

The Premier challenged the Members of the Opposition on their inconsistency, and pointed out that it was difficult for him to understand how they could be sincere and logical to their own attitude regarding the welfare of the workingman when they declined absolutely to consider for a single instant the interests of capital, upon which to a very considerable extent the development and prosperity of the country was dependant. They were so wrapped up in the rights of the workmen that they were not in a position to consider in a fair-minded manner the other interests of the country. In fact, he had never heard from the lips of either the Member for Newcastle or Nanaimo a single sentence that could be construed as conceding to capital the slightest consideration whatever.

Nothing in Charges.

"Now, sir, we come to the subject of the resolution, which asks that the confidence of the Government should be forfeited because of the strike at Cumberland. Who is there in British Columbia who proposes to follow the honorable Member for Nanaimo in his charges against the Government who will not conclude with me that there is no man in the Province who knows better than he does that there is little or nothing in them, either against the Department of Mines or myself as Prime Minister. The whole case of my honorable friend is destroyed at once by references to his very strong remarks favoring the recognition of the United Mine Workers of America, assuming control of the mine workers on Vancouver Island, because the organization had so much strength and power behind it. Of course his reason for the strike as given to the House was because the Department of Mines would not investigate a certain charge of discrimination which was submitted some months ago by members of certain organizations.

"The honorable Member for Nanaimo proceeded to argue that the workers on Vancouver Island would be foolish indeed if they attempted to set up a local organization in place of the all-powerful United Mine Workers. We know perfectly well that this is the bottom of the trouble, but it so happens that those who were in charge of the progaganda on the Island right from the start, felt that perhaps they might get a better footing if they could throw the blame on some individuals. and preferably on the Government. They have worked up their case studiously, and it is one which, unless investigated, would appeal to many, but, upon being carefully looked into, one can quickly absolve the Government from any blame in the matter, and as quickly place it where it rightfully belongs, and expose to the country and Canada as a whole that they themselves are responsible for the situation that exists to-day."

"Seeking a Dictatorship."

Proceeding to discuss the relation of the United Mine Workers to the strike situation, the Premier pointed out that the organization had taken the stand it had because it was felt to be a strong one, well knowing that to come out definitely and acknowledge its true attitude, which amounted to that of a dictatorship, would be rather an extreme step to take all at once. For his part, he said,

he had no word of criticism to offer the United Mine Workers of America. It had a perfect right to find a place for itself in this Province under the law, and he did not desire to give utterance to any sentiment that might be interpreted as being antagonistic to the organization.

"The Government is not opposed to international unions. On the contrary, I have tried to make it clear in the House and on the hustings that this Government has no desire to interfere in the relations between employer and employe; that these are matters that may be admitted by the parties directly concerned, and that, the moment any administration attempts paternal interference or control, the time has arrived when Governments and Legislatures are brought face to face with most complex and difficult problems."

Statements of Mr. Farringdon.

Reverting to the strike situation, the Premier reiterated his statement that the whole difficulty had arisen because it was proposed that the United Mine Workers should be in control of the vicious person I am. Yet they must be followed up by quoting extracts from a statement made by Mr. Farringdon, one of the principal officials of the United Mine Workers' organization. He showed from the statements of Mr. Farringdon that it was the object of the organization to obtain control of the coal mines on Vancouver Island, because, when that was accomplished, the organization would be in a position of entire control in the coalfields of the Pacific Coast.

"It appears that the coal mines of the Coast are for the most part in the hands of the United Mine Workers of America, but that at tidewater in British Columbia are the valuable mines of Vancouver Island, and, in order to have complete control of the labor situation as it affects the coalfields of the Pacific Coast, it is proposed that this union shall take possession of Vancouver Island. There is no law in the country against this course of action, but it must be remembered that there is a proper form in which the task should be approached."

Covering Up Motives.

He pointed out that there was no reason for the union organization to cover up their motives in this matter by endeavoring to shift the blame of something for which they were entirely responsible upon the Government. He could not understand why they should be ashamed of what they were doing and endeavor to bring it off in the dark, as Mr. Farringdon had done. There was no reason, he said, why the country should not have been told plainly and honestly that it was their intention to secure control of the miners on Vancouver Island and in that way the control of the coalfields generally.

The Lemieux Act.

Referring to the declaration made by the miners' representatives to the effect that they had gone on a holiday because they did not wish to go on strike as they were afraid of the operations of the Lemieux Act, the Premier said that he took the trouble to point out this act to them, but they would have nothing to do with it.

Calling Out the Militia.

"With regard to the calling out of the militia," proceeded the Premier, "it matters not whether the scene be the coal mining district, the metalliferous districts, or anywhere else, when, on certain reputable authority, it is alleged that disturbing conditions obtain, there is no other course for the Government to pursue than the one followed in this case, regardless of whether it means the life or death of the Government. And so it was in this case. I care not what the composition of the Government may be, Liberal, Socialist or Conservative, when the time comes in this country that the Government flinches from its duty in an emergency of this sort, then the day has come when responsible Government is at an end, and when the liberty of the subjects will have perished."

United Mine Workers' Organization.

The Premier concluded with a final reference to the United Mine Workers' Organization.

"They have the right under the law to conduct their campaign in their own way and also have the right, so far as they may be able to exercise it, to control the mines on Vancouver Island, but let it be remembered that in the exercise of a privilege of this kind they have no right to go beyond the law any more than anyone else, and although it may appear obnoxious and restrictive and unfair, they must never claim, under our constitution as we are taught to know and believe in it, that they have a bit more license than any of their fellows. There are constitutional means of settling all those questions, and let us abide by these if we propose to be at all worthy of the land in which we live.—The Daily Colonist.

BUTTE MINERS AND THE AMERICAN INSTITUTE OF MINING ENGINEERS

Patrick Corrigan
Benny Tibby
Consulting Miners.

Butte, Mont.
Feb. 14 1914
St. Valentine's Day.

Misther Rand;

Pres'dent American Institoot of Miners,
Rock-sharps, Metal-melters and Assayers;

Sorr;

The mimbers of this firm were glad to mate you and the other D'rectors of yer Institoot lasht sommer and we arre shure that we kin do yure Institoot a heap o' good. The gra'at throuble wid the Institoot this very minute is the ondoo infloonce of the High-brow Iliment. Ye hev got too mooch of these coll-idge perfissors, who aint no good aboot a moine and who do be allers making throuble. We know that ye, yersilf, come into offis afther the Institoot had had a bad dose of wan o' thim, and wot has set it on its two feet, solid-like is the fact that ye are a practical man. We know that ye are an old railroader, accoostomed to shtand off the Car-wheel Turners Union and the loikes o' thim ;and that ye've managed moines and know how to handle the lab'r'ing man. The Institoot has had wanderful succiss undher yure manidgment, but ye ought to allers beware o' thim high-brow fellers.

The grea'at future hope o' the Institoot lies in the fact that y' are to be succeeded by me old frind Ben Thayer, one of the foinest practical miners in Ameriky and an old Butte man himself. Shure I moind the time that Ben coom out to Butte, wid his collidge diplomy of Civil Ingineer, and how he felt he had to be civil to ivribody down in the ould Anniecondy shaft, where he got his first job with me and Ben Tibby. Shure he'd say "Beg yure pardon will ye give me the wrinch," and "Excoose me ye' ve got me shtriking hammer."

But we had to take all that nonsense out of him and bimeby he larned to talk like anny Paddy in the shaft. Oho! he was a [illegible] foine feller was Ben, and we're all proud of him here in Butte. He'll keep yoors Institoot booming along joost loike the Anniecondy moine. But wot I meant to imphisize was ye have got to knock the collidge bizness out o' these fellers before they're much good, and it's the Anniecondy shaft that giv' ye yure next Pres'dent and doant ye go to thinking anything diff-rent. I've seen a lot o' these collidge fellers in my toime. Some o' thim makes good miners and some o' thim don't, but goes to raisin' apples down in Wash'ton State. The boys that takes to minin' do be sometimes gitting quite a big wad. Sometoimes these fellers with the wads goes back to see their old perfissors and ye ought to hear thim tell aboot it when they come to Butte. "Shure," says wan, "there's Perfissor Flunkem," he says, "he busted me all to shplinters in Mining 206," he says, "or maybe Jollidge 77,55 he says, "or Ingeering 57A," he says, "but whin he see me coming the old humbug says, says he, thinkin' maybe he'd git a new lab'tery out o' me, 'Hellao Jack Hammond, me brave bye," says he, "we want ye for a perfissor," says he, or "Oho! if it aint me old shtudent Par-rk Channing," says he, or "By gracious, "it's me old Boy Chister, so 'tis," or perhaps, "well, Hennen, ye look a bit stouther and older in the face than the slim lad o' '75," says he; but all this blarney dont work or bomboozle the bhoys a bit, it dont. I foind all this out by talking wid thim, and it all goes to show ye've got to look out for these high-brow fellers in the Institoot.

Ye've been rather running thim too hard in the Committees, Misther Rand, but I'll coom round to yure Committee prisintly, so I will. I hev got a bigger thing than that on me moind now, so I hev.

Ye do be making a bad mistake in gineral policy, the way things do be going in this country, and it's going to get yure Institoot in the same throuble as is plaguing the New Haven Railroad; the Shteal Trust; the Rockyfeller crowd; the United Segarr crowd and all the rest. Ye see with thim Machinery chaps, and thim Illictrical fellers, ye've been gitting up a Thrust in Ingineering Sassieties and have put all yure m'terial prop'ty in the hands of a holdin' comp'ny called the United Ingineering Sassiety. The whole bizness involves the stifling of competition, interlocking d'rectorates, monop'ly, and all thim turrible things. As shure as ye're born, ye will have the Attorney Ginral of the United States on yure neck before ye know it. I doant know how yure going to divide up the big building among the Founder Sassieties and the Affiliated Sassieties; or how yure going to stand off the sleepless officers of the guv'ment; but my advice is to get yure new Prisident to appoint a Committee with Jahn D. Ryan, another Butte boy, as Chairman, and have him keep ye out of throuble, same's he has the Amalgamated.

Yure Institoot is now nearly out o' debt, thanks to me old friend James Douglas, for whom f'r a toime I pounded shteel in the old Copper Quane moine prop'ty. Shure the Copper Quane moine has been a fine thing for the Institoot, but ye might as well make other plans for the future. Ye cant expect to high-grade in the Douglas shtope much if anny more. I observe that the Kaiser Wilhelm is now said to be the richest man in Germany, and I think ye might make him Honor'ry Lootenant Gin'ral or Hon'ry Grand Field Marshall of the Institoot, wid a big sword, and maybe he'd do something handsome fur ye.

I note that undher yure manidgment the policy of Committees has been diviliped widout end. That's another Butte idee in spechulization. Ye got it the lasht toime ye was out here from Hennessy's big Department Stoore, right down undher the Annycondy offises. Hennessy has a pins and needles department or committee, wid a speshul floor-walker or chairman; a pants and overalls department wid its own floor-walker; a pick and shovel committe wid its chairman who is a spshulist in iron and steel; and so on, and so on. Hennessy adds wan new department or Committee a week, same's you do; and he's growing like hell punkin vines, running all over ivry where, same's you be.

But I'll tell ye this. Hennessy dont be putting no collidge perfissors in the floor walkers jobs. Bet yer life he doant. Now take fer instance yure Committee on Mining Jolligy. Who'd ever want to moine Jolligy. Jeeoligy means rocks and no miner mines rocks if he can help it. He mines ore. But if ye must have this Committee it's a dam good wan f'r the collidge perfissors. Round 'em all up and put 'em on it. I hear ye tried to git one of them who hadn't been a collidge perfisser very long f'or the floor-walker of this committee but he wouldn't stay on the job. Gee! if he'd been a collidge perfisser ten years ye couldn't a pried him off with a crow-bar.

And then, there's the "I run and Shteal" Committee; ye've got another wan o' thim high-brows there. I doant know what it'll be coming to. Afther a good practical man like yersilf, and afther the great, practical jurnalist of the Institoot set it a-going, it's too bad to lave the paapers on good, furniss cinder and pig iron behind, and discoos the "A3 diagram o' carbon" which doant say nothing about iron or shteel eether. Now take the Peetroleum and Gas Department, undher the greates Floor-walker of thim all, me ould frind Cap'n Tony Lucas. Look what he do be doin'. So much Gas it do take three full days of the annual meeting to blow it off, and all the other Departments c'n go to hell some other building to meet in.

And now I must say a worrd fer yure Secret'ry, the reformed high-brow. Ye caught him young enough to make quite a man of him yet, and I do be hearing the bhoys say he's the rale stuff.

I enclose me bill, and I head off me pardner, Ben Tibby from ventilating yure Institoot anny more. Annyhow I've had me chanct to pay me respicks to yer ould high-brows and I'd raher do the job f'r nuthin' than not hev the chanct.

Respectfully,
PATRICK CORRIGAN,
Consulting Miner.

CANADIAN NORTHERN RAILWAY MOUNT ROYAL TUNNEL.

In our last issue we published an account of the driving of the Mount Royal tunnel. This account was written originally for the Sullivan Machinery Co. by Mr. D. J. O'Rourke. Naturally, under the circumstances, attention was directed especially to the results obtained by Sullivan machines.

It should not be inferred, however, that these were the only machines used on the work.

In addition to the Sullivan machines, over 30 Hardy Simplex hammer drills were used in the tunnel. A considerable proportion of the drilling was done with these machines, especially in the trimming work.

CHECKING THE FLOW OF WATER INTO SHAFTS BY THE USE OF CEMENT GROUT*

By Francis Donaldson.

The direct injection of cement grout into water-bearing fissures as a means of checking or stopping the flow of water into shafts and tunnels has been experimented with for a decade or longer and seems to have been first attempted in Europe. The earliest application of which the writer has found a record was at a shaft sunk by the Mining Society of Lens; this is described by C. Dinoire in the Transactions of the Institution of Mining Engineers.

It is only lately, however, that the process has been entirely successful. This success has been accomplished on the Catskill Aqueduct, now under construction by the city of New York. This aqueduct includes a number of deep pressure tunnels, reached by shafts for both waterway and construction purposes. In portions of these shafts and tunnels considerable underground water was met. The contract for the first of these deep pressure tunnels was let to the T. A. Gillespie Co.; this section is known as the Rondout Siphon. It leads under the Rondout valley at a depth of from 400 to 800 ft. and is about 5 miles long. The engineers expected that considerable water would be encountered, but fortunately this was not the case, except at one shaft, known as No. 4, which penetrated the rock at a junction between limestone and conglomerate. Water-bearing fissures were encountered almost immediately. At a depth of about 200 ft. a flow of 1,500 gal. per minute was struck. The shaft then contained as many pumps as could be used, and it seemed impossible to sink it further. After vain efforts had been made to proceed, John P. Hogan, a division engineer of the Board of Water Supply, suggested that cementation of the fissures be tried. The process was attempted for the first time in this country. Since the shaft was partly full of water it was necessary to drill grout holes with a diamond drill. Platforms were placed on the timbers at the water level, the diamond drill was installed, and six 90 ft. holes were drilled in the bottom of the shaft. Several carloads of cement were pumped through these holes into the fissures, the drill casings being used for grout pipes. This largely cut off the flow of water from the bottom and sinking could then proceed. After that, water-bearing seams were grouted as soon as encountered, and the contractor was able to finish the shafts and tunnel within the contract time. Shaft No. 4 was a rectangular, timbered construction shaft with no concrete lining; consequently it was impossible to cut off any of the water coming in from above the point where grouting was first attempted. On this account large volumes of water had to be pumped until the tunnel was finally sealed.

At the next wet shaft the writer had to do with, advantage was taken of the experience gained at shaft No. 4. At this second shaft, No. 4 of the New York City Siphon, good progress was made until a depth of about 100 ft. was reached. The first hole drilled in the bottom below this depth struck a stream of water; the flow amounted to about 150 gal. per minute. This was plugged. It was found that each of the 12 holes in the sump cut encountered the same stream of water.

As soon as each hole cut the water-bearing seam it was plugged with a tapered wooden plug. After all the holes in the sump had been drilled and plugged in this way, the grout connections were made one at a time, so as to restrict the flow of water into the shaft. Each connection was made with a piece of 2 or 2.5 in. iron pipe about 3 ft. long, threaded at one end and given a long taper at the other. The tapered portion was made rough on the outside by nicking it with a chisel. A heavy iron stopcock was screwed to the pipe, the tapered end wrapped in several thicknesses of burlap, the wooden plug removed from the drill hole and the tapered pipe driven in, the stopcock being left open. This was the most exciting and the wettest part of the job. After the pipe had been driven in hard the stopcock was closed.

In this case connections were placed in all the wet holes before grouting. The grouting machine or tank used on the aqueduct was the Caniff machine, in which the grout is mixed by air. It is built like an air lock with a door on the top, through which cement, sand and water are introduced, and has a 2 in. discharge opening in the bottom and air connections top and bottom. The discharge opening is connected to the grout hole by a heavy rubber hose. Another 2 in. stopcock is placed at the outlet of the tank and a 2 by 1 in. tee is placed between the hose and the cock attached to the pipe in the drill hole. Into the side opening of this tee a 1 in. stopcock is screwed.

The machine is installed at the bottom of the shaft, and is connected to one of the holes and also to the high-pressure air supply. The 2 in. stopcock on the machine is closed and the other is opened. The door in the top is opened, a sack of cement, three or four buckets of water, and (if the cavity to be filled is large) a sack of fine sand are poured in, the air connection at the bottom is opened and the air allowed to bubble through and mix the grout. Then very quickly the door is closed, the lower air connection is closed, and the discharge connection and the upper air connection are opened, and the air enters and drives the grout into the cavity. A man stationed at the 1 in. stopcock keeps opening it a crack; when air shows instead of grout he closes the 2-in. stopcock and the machine is recharged. If the cavity is open the charge is pushed in in 3 or 4 sec. By working continuously more than 1,000 batches can be placed in 24 hours.

The grouting of the fissure was successful and sinking was resumed. About 50 ft. further down another water-bearing fissure was drilled into, and this, instead of being open, was filled with sand formed by the crushing of metamorphic gneiss due to folding; this sand was carried up out of the drilled holes in large quantities by the water. Grout will not permeate sand and it was necessary to continue drilling holes and pumping in grout, increasing the pressure at the end from 100 to 400 and 500 lb. to the square in. The sand was tamped so full of cement that when cut through it was compacted like sandstone and contained balls of grout from the size of a fist to as large as a man's head.

The most difficult grouting on the aqueduct was done on the Hudson Siphon, which is a deep siphon tunnel under the Hudson river at a depth of 1,100 ft. below tidewater. The shafts were sunk by the city forces,

*A Paper Read at New York Meeting A.I.M.E., February, 1914.

after which the contract for the driving and lining of the tunnel and lining the shafts was let. About 150 ft. from the foot of the east shaft the heading cut a water-bearing fissure which flowed about 300 gal. per minute. The full flow did not develop until the cut was blasted. The problem then was to grout this flow against a hydrostatic pressure of 500 lb. per square in., with no solid rock to which to make grout pipe connections. This problem was finally solved by the construction of a concrete bulkhead 8 ft. thick across the full section of the head. The concrete was mixed in proportions of 1:2:4 and was heavily reinforced with rails set into holes drilled laterally into the sides, roof and floor of the tunnel. Grout pipes leading into the fissure were set through the bulkhead. After the concrete had set for a week, grout was forced into the fissure, first by the pneumatic process with a high-pressure air compressor and finally by means of a high pressure plunger pump which forced water instead of air into the grout tank. Pressures were reached in this way up to 1,000 lb. per square in.

In driving or sinking through rock containing a large number of seams carrying small quantities of water, it is not practicable to stop and grout each seam as described above. In this case it is advisable to increase the section of tunnel or shaft sufficiently to allow for a heavy concrete lining. Drains should be provided opposite all of the water-bearing fissures to carry off the water while the lining is being placed. After the concrete has secured sufficient strength, the drains may be grouted. By a combination of these two methods it should be possible to penetrate any firm rock, no matter how much water it contains.

BRITISH COLUMBIA COAL COMMISSIONERS' REPORT

Last year Mr. W. E. Burns, of the City of Vancouver, was appointed by the Government of British Columbia to make enquiries into various matters connected with the cost of coal to consumers and to obtain all available information relative to this question. His report was recently delivered to the Government. The Daily Province, of Vancouver, on January 27 published the following review of the report:

Bulk delivery of coal instead of delivery in sacks as at present, reduction on freight rates from the interior of British Columbia, establishment of sizes and quality of the various classes and grades, supervision of such classes and grades, and supervision or inspection of mine weighing and weights are recommended by Coal Commissioner W. E. Burns, of Vancouver, in his report which is now in the hands of the Provincial Government authorities. Commissioner Burns forwarded his report to Victoria last week, and it has been before the Provincial Executive for consideration.

It was stated that there is little likelihood of legislation being framed during the present session upon the recommendations of the report, as it is the desire of the authorities to give the various interested parties ample time for looking over the findings of the commissioner, and presenting suggestions. It is believed, however, that something in the way of legislation along this line will be brought down next year.

Mr. Burns' recommendations follow: The establishment of the sizes and quality of the various classes and grades of coal known to commerce as applicable to all of the different coal fields of the Province.

The establishment of a method of supervision or inspection, Government or otherwise, of classes and grades of coal sold and dealt in with accompanying incidents of enforcement. This object might be accomplished by the natural working out of the opposing interests of buyers and sellers in the trade if sizes and quality were standardized.

The establishment of a method of supervision or ininspection, Government or otherwise, of mine weighing and weights.

Consideration of the advisability of adjusting conditions in the industry at present upon the long-ton basis to the short-ton basis.

The establishment of bulk deliveries to the customer in the larger places at least, either by means of legislation or by arrangement with the civic authorities with accompanying inspection and regulation of weighing methods. In connection with this steps should be taken to ensure that reduction in prices to the consumer which the elimination of costs established would warrant.

Consideration of the advisability of steps being taken to afford if possible a sufficient reduction in rates on coal from the interior to the coast to enable the interior mines to compete in the coast trade.

Mr. Burns, during his investigations, which were commenced at least a year ago, was required to take up a large number of phases of the coal-price situation. Among other things, he enquired into the cost of production, cost of transportation, cost to dealers within and outside of the Province, cost to consumers within and outside of the Province, profits made by mine-owners, profits of dealers, alleged shortage of coal and reasons for such shortage within the past five years and whether such shortage was occasioned by the shipment outside of the Province or coal mined here.

A portion of the report covers an account of the sessions held during the investigation and the obtaining from the operators of accountancy statements. In this connection the commissioner states that operator and dealer without exception met him with an attitude of complete and unreserved disclosure of their business details and methods. In addition to examining consumers, dealers and operators, the commissioner went through various mines in the Provinces and also visited the yards and plants of city dealers.

Summarized, the principal complaints made to him by consumers were: High prices, inferior quality, shortage in weight and shortage of supply.

Dealing with the methods employed by operators and dealers in handling coal the commissioner explains that as the coal of the Province is of a soft and friable nature the operator has had to look to the large or lump coal for his profit, and the dealer in turn has had to look forward to and absorb a loss on the smaller coal and on the slack created in transit of the lump coal.

A lengthy account is given of the mining of coal and also of the way in which the dealers handle it, which is followed by a discussion of production costs. The commissioner gives the following figures as the average cost per long ton of the mines upon a permanently producing basis in the Province: 1908, $2.71 to $3.19; 1909, $2.68 to $3.21; 1910, $2.56 to $3.34; 1911, $2.78 to $3.36; 1912, $2.44 to $3.46. These figures would appear to show that the cost of production at the mines has not changed materially, although the maximum cost has steadily risen. Important features of the mining production costs, he points out, are: The fact that a comparatively large amount of rock paid for right through the mining costs without return, the fact that the percentage of the total production of screenings made at the tipple ranges from 30 to 50 per cent., and the varying prices of both contract and company labor.

A full table of water rates to the chief cities along the coast is given. The figures show that from Ladysmith and Union Bay the rate to Vancouver is 50 cents, including insurance; 45 cents from Boat Harbor with insurance additional; 50 cents from Nanaimo, including insurance; 60 cents from Seattle and 70 cents from Tacoma. There is an additional charge of five cents per ton for False Creek dealers for transferring in from English Bay. The rail rate to Vancouver from Merritt is $1.80, with $3.50 from Princeton, Crowsnest and Bankhead.

It is noted that most of the larger dealers do a wholesale coal agency business, receiving from the mines a commission on direct sales of scowload or carload of from 3½ to 5 per cent. Since 1907 the selling prices of the Vancouver Island mines have remained about the same, the coal being sold there by the long ton, and from the interior mines by the short ton. With the exception of the Vancouver-Nanaimo Coal Mining Co., which sells lump coal at $4.75, the prevailing price is $4.50. These prices are at the mines. The Nicola Valley Coal & Coke Co. sells at $4.50 to $5 at the mine for lump coal; the Princeton Coal & Land Co., at $3.50; The Inland Coal & Coke Co. at $4; Crownsnest Pass Coal Co., $3.25, all these prices being for screened lump coal. Prices at American mines sending coal into British Columbia are also given in detail.

That there is no unreasonable profit in any branch of the industry is one of the conclusions arrived at by Commissioner Burns. He states that dividends have only been paid by three of the operating companies up to the end of 1912, and these dividends have in no case averaged over 10 per cent. covering the period of operation.

Storage of Coal.

In connection with the question of shortage he points out that the absence of storage methods on the part of dealers is due to the extra handling required, the outlay of money, danger of fire and deterioration in the coal. The stock on hand, he says, has hardly ever been as large as would equal an average month's business in a colder period of the year. The mines do little storing and the dealers only attempt it to some extent in the summer. The commissioner himself does not think that the establishment of any greater storage facilities by the dealers could be required. For householders, he suggests that two bins for a ton each, be provided, and both filled to start the winter, an order for an additional ton being placed as soon as one is empty. He points out that it might be a good move on the part of dealers to offer a discount for coal sold during the summer months in order to induce consumers to lay up a winter supply early.

Speaking of the outside supply provided by mines, he states that evidence produced before him shows that the Vancouver Island mines have cut off their outside markets when the local markets demanded their full capacities. Coal shortages have in the past arisen out of abnormal conditions, he thinks, and little danger would occur if dealers spread their sales more uniformly throughout the year and the operators preserved a policy of serving local demands first.

The 50 cents extra charged by the Vancouver-Nanaimo Coal Mining Co. for its coal, it is explained, arises out of the fact that this concern signed up with the United Mine workers during the recent strike at an increased scale of wages, and therefore provided with its agents for an increased price of coal until the other mines were operating to their full capacity.

PORCUPINE CROWN.

(Financial Times, Montreal.)

The main vein of the Porcupine Crown has been cut by a crosscut on the 500 ft. level, where the vein was about 5 ft. in width and of high grade ore. It will be remembered, by those who follow Porcupine Crown developments, that the winze which was sunk on the vein below the 400 ft. level was in good ore until a point 70 ft. below the 400 ft. level was reached, at this point the vein was over 5 ft. in width and assayed $70 per ton; the vein then dipped out of the winze. The crosscut which was run at a point further to the south cut the vein at the point anticipated, and showed up equally good ore.

Developments on the vein at depth seem to show that the ore shoot is, at the lower levels, further to the south than is the case on the upper ones.

Recent developments have been very satisfactory from other points than developments on the main vein now being worked. The extensive campaign of diamond drilling has been of great importance and most successful.

A development of importance is the cutting of what appears to be an entirely new ore body, some 200 ft. to the east of the main vein. The vein, judging from its position where cut is almost directly under a vein which was found in the trenching first done on the property, and which carried values.

It may, however, be an entirely new vein on account of uncertainty in surveying drill holes. The extension of the main vein to the south, as found by diamond drilling, should be cut in about a month by the cross-cut now being run on the 200 ft. level. At the new shaft (No. 5), which is being sunk towards the southern boundary of the property, crosscutting was discontinued at the 160 ft. level, and a new crosscut was recently started to develop ground at depth which diamond drilling showed a vein carrying high gold values. This is apparently a further extension of the main vein to the south. The diamond drilling operations also cut the main vein at a vertical depth of 600 and 700 ft, from both of which points cores carrying free gold were obtained.

The next few months should witness some very important developments at depth, which will connect up the various present workings and show the true length of the ore shoot on the main vein, and also cut either veins which recent developments have shown to exist at depth, as well as on the surface. The important feature of recent work is the fact that on every adjacent property diamond drilling has been a sure indication of the presence of ore bodies, and subsequent work in the ordinary course of mine development has only gone to prove the importance of diamond drilling in prospecting for ore bodies.

PORCUPINE THREE NATIONS.

The annual meeting of the Porcupine Three Nations was held last week at the office of Day, Ferguson and O'Sullivan, Toronto. The principal business was the confirmation of an agreement for the transfer of the company's mines to a new company, to be called the "Porcupine Three Nations Consolidated," which is controlled by Treffle Bastion, J. T. R. Laurendeau, and J. W. Blanchette, of Montreal, who have agreed to erect a stamp mill and cyaniding plant, and a power plant, and to actively carry on the mining development. The Three Nations property is in Whitney Township.

GOWGANDA SILVER DEPOSITS**

By W. H. Collins.

Since 1903 silver-cobalt ore has been found locally across the whole width of Nipissing district—72 miles—and for an almost equally great distance north and south. The whole included area is not less than 1,600 square miles. About 650 square miles of this lies within the limits of the accompanying map, chiefly in its southeastern half. The known productive part of this 650 square miles is practically confined to the diabase formation. As the diabase is not uniformly mineralized, it is possible to further limit attention to a number of localities that include most of the known deposits and in which mining camps have been established. James township and portions of Willet, Mickle, Farr, Smyth, and other townships to the east may be called, collectively, Elk Lake district, as the village of Elk Lake forms their business centre. Gowganda village is in like relation to operations in Milner and Nicol. While these two townships include a large majority of the working properties in Gowganda district, others are scattered through Leith, Charters, Lawson, Haultain, Van Hise, and even as far as Morel. A small and isolated silver-bearing area in Leonard township is commonly designated Shiningtree district owing to its proximity to Shiningtree lake. The properties in Speight and Van Nostrand townships, just east and southeast of Banks, lie along the eastern side of Maple mountain, and are known consequently as Maple Mountain district.

In all four districts mineralization rarely extends beyond the diabase formation. The principal vein on the Blackburn or Millerett property at Miller lake lies in conglomerate not far from diabase, and one on the North American claims at Silver lake traverses both diabase and an overlying quartzite, but these are the only important ones known to occur in the Huronian. At Cobalt, on the contrary, most of the ores have been found in Huronian rocks. The significance of this difference is not yet known. Diabase and Huronian are of similar character in both districts, and the Huronian has been little folded in either. But while the diabase throughout Gowganda district bears to the older rocks the relations of tabular sills not often exceeding 500 feet in thickness, recent underground developments at Cobalt are leading to the opinion that the diabase is more irregular in form and may extend to very considerable depths.*

Few of the mine workings are over 150 feet deep, so comparatively little is known about the vertical extent of mineralization. Some inferences may be drawn, however, from the general restriction of veins to diabase masses. Apparently veins do not extend far above or below the diabase sills, and the thickness of the latter determines the depth to which they may go. For the same reasons veins are not likely to extend far below the base of the Cobalt series, since diabase sills are not known within either Keewatin or Laurentian, though they commonly rest upon these formations. However, the sills cannot be considered as uniformly thick, especially where they lie upon the unequal surface of the crystalline basement, nor can the possibility of local divergences from the general sill form be entirely excluded.

General Character of the Deposits.—The ores occur in distinct veins of small size. Very large ones are 18 inches or 2 feet wide and the majority are from half an inch to one foot. As a rule they occupy well defined vertical fissures in the diabase or Huronian, extending in nearly straight lines along the surface. Devious, forking veins were seen only on the York property near Silver lake, where they appear to have been influenced by a columnar jointing in the diabase. A large number near Gowganda extend nearly east-west, and others nearly north-south, but for the entire district the strike shows little distinctive regularity. Locally, however, the veins have a conspicuously parallel arrangement. On the Mann property (H.R. 252), west of Gowganda lake, for example, there are four veins only a few yards apart, all of which strike N. 15° E. Seven parallel north-south veins occur within a total width of 300 feet from east to west on the Neeland claim (H.S. 448) in Shiningtree district. In most cases the veins have not been traced for more than 400 feet, owing to their disappearance, junction with other veins, or to the work of stripping becoming too difficult. Occasionally they are longer; a 20 inch vein in the diabase between the two arms of Gowganda lake is traceable for 1,500 feet, crossing one mining claim.

Being largely calcite-filled, the veins erode more rapidly than the country rock and are represented at the surface by crevices, either empty or filled with soil. In some cases they are concealed by a firm but thin cap, formed by recementation of the weathering products. This is frequently mistaken for diabase by prospectors, and has led to the belief that veins may be "capped" by diabase. The inconspicuous surface expression is further increased by the moss and forest growth which cover much of the area. But on cliff faces and other exposed rock surfaces, a useful exploratory criterion is afforded by cobalt bloom, a weathering product of smaltite, which produces a characteristic pink or carmine red stain.

Veins and wall-rock are separated in clear-cut manner. The latter has been affected to some extent by vein solutions for a distance of about a foot, and contains some silver and smaltite, chiefly as minute crevice fillings. A considerable part of the low grade ore is obtained from this impregnated wall-rock. Within the veins gangue and ore minerals vary greatly in relative amounts; in many cases the latter are represented only by scattered grains of chalcopyrite. Even in rich veins the ores are not as a rule uniformly distributed, but have been concentrated in patches a few yards in extent, leaving other parts of the same vein practically barren. Some of the phenomenally rich surface discoveries made at Gowganda in 1908 were of this character. A continuous spine of native silver averaging half an inch in width was exposed for about 20 feet along one vein on the Mann property, and slabs of ore, two of which weighed 240 and 160 pounds, respectively, were taken from near the surface of the Reeve-Dobie claims.

Silver is the important metal. Native silver, smaltite, and niccolite are the principal ore minerals, and calcite the chief gangue mineral, though quartz is also present. The proportions in which both gangue and ore minerals are associated is variable, however, and veins in different parts of the district are so unlike, consequently, that their common origin can be recognized only by their like relations to the diabase. Quartz veins carrying chal-

**Extract from Report on Gowganda Mining Division, Mem. No. 33, Geol. Sur. Canada, 1913

*Canadian Mining Journal, March 15, 1911, page 194.

copyrite are found in the diabase at Duncan lake. One of the veins on H.S. 448, near Shiningtree lake, consists, in its mineralized part, of massive niccolite unaccompanied by either smaltite, gangue, or silver. Those on H.B. 42, Lawson township, on the contrary, consist chiefly of smaltite, with some silver but little or no niccolite. Some of the largest veins near Gowganda are unmineralized and consist entirely of calcite. A small vein of solid chalcopyrite parallels an aplite dike in the diabase at the United States mine, James township.

Ore within a few feet of the surface differs in no respect from that obtained 150 or 200 feet down—the present depth of mining. Alteration is confined to a surface zone, apparently not often exceeding 6 feet in thickness, where calcite has been leached out, and the sulphides and arsenides oxidized. Smaltite changes to a powdery red erythrite or cobalt bloom, and niccolite to the corresponding nickel bloom, or annabergite, of pale green color. Limonite and azurite result from chalcopyrite where that mineral is abundant.

Composition of Veins.—On account of the common preponderance of calcite over quartz in the veins, the presence of the latter is often overlooked. However, it is present in most veins and sometimes becomes the chief gangue. Some of the veins that accompany the Duncan lake diabase sill are composed almost wholly of quartz with central vugs occupied by calcite. Generally, however, calcite is more abundant and quartz inconspicuous or even absent. But while they fluctuate relatively in amount their structural arrangement is constant. Quartz always grows from the walls toward the centre, its individual crystals terminating freely in a usually large median space which is filled with calcite.

Barite veins are much less common than those containing calcite. They occur in company with the latter and bear similar relations to the diabase. They consist of quartz and diabase, and appear to be mineralized chiefly with chalcopyrite. One occurs not far from the shaft of the Calcite Lake Mining Company's mine, on L.O. 357, Lawson township. Others have been found in Shiningtree district and in James township.

The ore minerals form a characteristic group of native metals, sulphides, arsenides, and related compounds of cobalt, nickel, silver, and copper. Native silver is of chief economic importance. It occurs in flakes and a network of veinlets that traverse smaltite, niccolite, and calcite in the veins and, in less profusion, a few inches of the adjacent wall rock. In samples from the White Reserve mine, in Maple Mountain district, it has the appearance of being enclosed by smaltite. Crystal form is known to occur only at the surface of the Mann property (H.R. 252). The first discovery on this claim was a protruding spine of native silver of spongy or arborescent texture, in reality a skeletal arrangement of plates and string of tiny octahedra arranged in three planes intersecting at right angles to each other. The silver met farther down in unweathered portions of the same vein was of the usual irregular form. Small lumps of argentite were found in a small vein of smaltite on one of the Mann group of claims.

Smaltite ($CoAs_2$) and niccolite (NiAs) are the chief arsenides present. Both are massive, and mutually intergrown when found together. At the surface smaltite oxidized to Cobalt bloom ($Co_3As_2O_8+8H_2O$), niccolite to annabergite ($Ni_3As_2O_8+8H_2O$). Imperfect crystals of native bismuth, with striated faces, occur embedded in calcite at the Boyd-Gordon mine, Gowganda, and the Otisse mine, Silver lake; lumps of it were found also on the Lett property at Wapus creek.

Chalcopyrite is more abundant than any of the other minerals, but this fact is obscured by its inferior commercial value. It is particularly common in Elk Lake district, where veins of it are often associated with aplite dikes. The quartz veins in the western part of the district contain this mineral alone and often in considerable masses. It is enclosed by calcite and quartz alike, while the arsenides and native silver appear to associate only with calcite. Disseminated grains of chalcopyrite occur throughout aplite and diabase. Ordinarily it weathers to an earthy brown mass composed largely of limonite, but in veins near Mosher lake azurite crystals have developed from it.

Other minerals occur in unimportant quantities and more or less sporadically. Specularite is common in James and Corkill townships. Pyrite is wide-spread. Magnetite was observed at one point between the northeast and northwest arms of Gowganda lake. In trenching along one vein, a party of prospectors had uncovered a second cross vein filled with a heavy black veinstone, which proved to be calcite filled with microscopic octahedra of magnetite. Galena is found with chalcopyrite in the quartz gangue. Stibnite occurs some miles south of Shiningtree district.

Judging by its constant growth from the walls toward the interior of the vein, quartz was evidently the first formed vein constituent. Chalcopyrite and galena began to deposit at about the same time, as they occur within the quartz. The remainder of the succession has been worked out by Campbell and Knight, from examination of polished ore surfaces. They find that smaltite and niccolite were deposited next and evidently simultaneously, since the two are intergrown. A period of movement succeeded, during which small fractures were formed. Later, calcite and argentite appeared and the fractures became filled with native silver. Bismuth crystallized later than the silver.

Genesis.—The consistent association of the silver-cobalt veins with quartz diabase sills is the most thoroughly demonstrated and significant fact bearing upon their origin. Nowhere in Gowganda district have veins of this type been found in older rocks except in the immediate vicinity of a diabase sill. They are closely restricted to these intrusions and occur in all the large ones that have been described. Though the formations intruded by the different diabase masses are not the same, the veins associated with one sill do not differ notably from those related to another. It is difficult to escape the conclusion that diabase and ore deposits are intimately related. Such a relation was accepted when exploration in Montreal River district commenced, and has proved serviceable in the search for veins.

BEAVER

Cobalt Feb. 25.

The fiscal year of the Beaver ends on Saturday of this week, and when the annual meeting is held at some future date the report will show an increased production. President Frank L. Culver, who is in camp, does not know the exact increase, as the records have not been all checked up, but intimates that a substantial increase will be the result of the year's work.

MICHIGAN COPPER DEPOSITS*

By Reginald E. Hore.

Mode of Occurrence of the Copper.—Practically all the copper mined occurs as the native metal. Arsenides and sulphides are found in some small veins, but the tonnage mined is very small. One lode, the extent of which is not yet known, has copper in the form of oxide, silicate and carbonate minerals.

The native copper occurs chiefly in bedded deposits. It fills cavities and replaces mineral and rock constituents of conglomerates and amygdaloids. By far the richest lode is a conglomerate, but all the others now being worked are amygdaloids. Other types of deposits are fissure veins cutting across the formation, epidotic beds parallel or nearly parallel the formation and disseminated copper in sandstone. Copper has been found in a much altered and fissured mass of felsite.

The bedded deposits are long and continue to great depths. The most important ones are worked for a distance of two to five miles along the strike. Two of the lodes are still being worked at over a mile down on the slope of the beds, and it is probable that others will be worked to a like depth. Most of the lodes average over ten feet in thickness and some over twenty.

Conglomerate Lodes.—In the conglomerate lodes the copper occurs chiefly in the matrix, and has irregular branching forms suggesting that it has filled cavities in the porous rock. In other cases, however, there is copper in forms which show that it has taken the place of other constituents in the rock, and in many cases it has partially replaced large pebbles.

Amygdaloid Lodes.—In the amygdaloid lodes the copper occurs partly, with other minerals, filling the amygdules. Much of it, however, is not in the form of a filling. As a rule the rock carrying high values in copper is to a large extent made up of secondary minerals, and the metal is usually enclosed in masses of these, especially in calcite, epidote, chlorite, prehnite and quartz. The copper, like these and other secondary minerals, is in such cases evidently a replacement deposit.

Fissure Veins.—In fissure veins the native copper occurs in masses, very irregularly distributed. The most usual immediate associates of copper are epidote, prehnite and chlorite. Calcite is abundant in most veins, but calcite veins not showing these silicate minerals seldom show copper. The veins worked were narrow in the traps, but widened out where the fissure crossed more porous strata. Commonly there are numerous masses of country rock enclosed in these veins, all of which cut across the formation and are nearly vertical. A large quantity of metal was taken from such deposits at the Cliff and Central mines years ago, and a very rich vein is now being worked at the Ahmeek mine.

The Chief Producing Lodes.—A large number of lodes are being worked. The most important producing lodes are the Calumet conglomerate and the Kearsarge, Baltic, Pewabic, Osceola and Isle Royale amygdaloids.

The Calumet lode is the cupriferous portion of one of the conglomerate beds in the lower Keweenawan series. This bed continues for a distance of several miles, but the ore bearing portion is confined to that part, about two miles long, which outcrops on the property of the Calumet and Hecla Mining Company, and which at depth crosses into the property of the Tamarack Mining Company. On other properties north and south, development of the conglomerate has not proven profitable. The best ore was in two shoots at Calumet and South Hecla shafts pitching north at about 70°.

The conglomerate rock mined is made up largely of pebbles of felsites and quartz porphyries cemented together with small particles of rock, calcite and native copper. The cementing material contains also, in smaller amounts, other minerals such as iron oxides, quartz, epidote and chlorite. There are a few pebbles of melaphyres, amygdaloids and porphyrites.

The conglomerate is characteristically red, both pebbles and the cement being commonly of that colour. Most of the constituents are of light tones; but a considerable portion is made up of pebbles that are dark reddish brown. Most of the lighter coloured pebbles, light red or flesh colored, are dense felsites and quartz porphyries. The darker coloured ones have usually a finely felsitic ground mass with phenocrysts of brown red feldspar. Other dark brown ones have a very dense ground mass with phenocrysts of quartz. Some are dark coloured felsitic rocks with no phenocrysts. Many of the pebbles show an outer rim of lighter colour than the interior. This results from alteration.

The small rock particles in the matrix are similar in character to the pebbles, but have been more extensively altered. The copper occurs chiefly as part of the cement, filling spaces between sand grains and pebbles, but some has replaced the rock constituents. It is a common occurrence to find large pebbles partially replaced by native copper, and at some rock houses a number of these are picked out every day. While most of the copper is coarse, much is in very minute particles and the ore has to be finely ground to permit of its recovery.

When a large section across the lode is exposed, as in the drifts and stopes, there are usually to be seen rather distinct light and darker colored portions. The copper is chiefly in the light colored portions. The darker colored places are noticeably more compact and less altered than the lighter. They have evidently not been much influenced by the solutions which in more porous parts altered the rock and deposited native copper.

The thickness of the lode, as determined by mining operations, is from ten to twenty feet. There are some thicker and thinner parts. Near the surface at the Calumet mine the lode is about thirteen feet, at some levels at great depths at the Tamarack mine about twenty-two feet and at similar depths further south in the Hecla mine only about ten feet thick. The average thickness of the ore still to be mined is said to be about fifteen feet. The thickness sometimes varies considerably in short distances. According to Capt. Dariell, the thin portions "seem to occur in spots rather than in regular courses." As a rule the values are irregularly distributed from wall to wall. In places the poorest part of the lode is near the hanging wall, and there are places where the upper portion is the richest. In extensive workings tributary to one deep shaft the portion next the footwall was always the least productive.

At the Calumet mine the lode strikes N. 33° E. and

*Extracts from the writer's report to Michigan Geological Survey for the year 1911.

near surface dips to the N. W. at an angle of about 38°. At the South Hecla mine the dip at surface is 39°. At depth the angle of inclination is slightly less than at surface. One shaft, following the lode closely, is inclined at 38° down to the 36th level, and below that at 37° 30′.

The copper content of the conglomerate in the upper levels averaged 2% to 5% for a large output. In 1888, when the C. & H. mine was about 3,000 feet deep the ore mined yielded 4.5% copper. In 1900 the ore mined averaged 3% copper; but the workings below the 57th level in the northern part of the mine have yielded ore of much lower grade. The average for the Calumet and Hecla mine for 1910 was 30.12 pounds per ton, while the output of the Tamarack mine in the same year averaged 21.1 pounds copper per ton of ore.

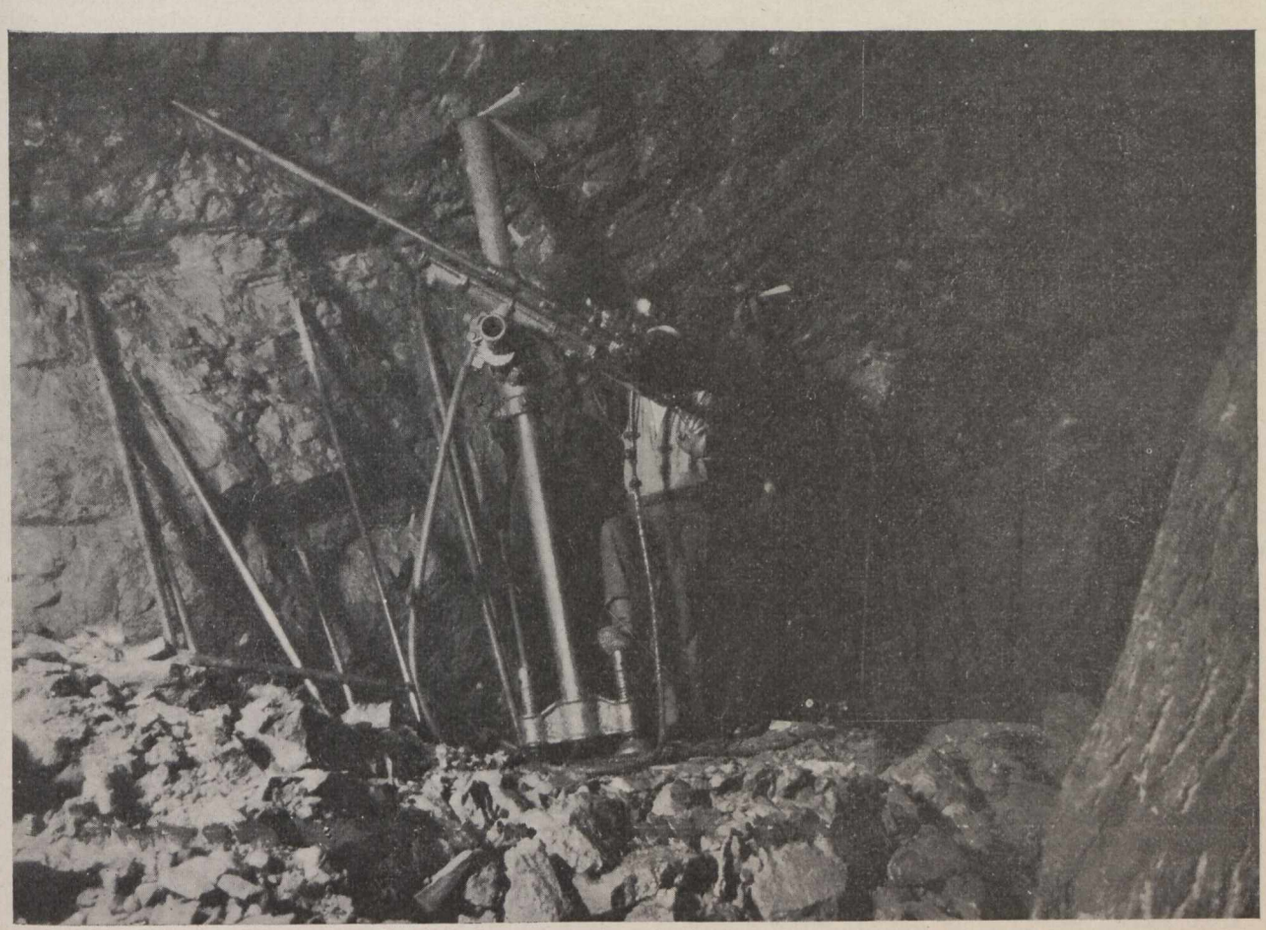
In the mines blocks found to be low grade are left standing but aside from this there is little selection of the ore. Practically all the conglomerate broken in the stopes is hoisted and stamped.

The conglomerate lode has yielded more copper than any other on Keweenaw Point, and the metal has been won at a cost which has made the Calumet and Hecla the leading dividend producer among the mines of the world. The Tamarack mine has also a good record.

Mr. J. R. Finlay estimated in 1911 that the C. & H. had still on the conglomerate lode about 27,000,000 tons of ore, which should yield 26 pounds per ton—a total of 702,000,000 pounds copper. Another estimate in 1911 was 30,000,000 tons, 900,000,000 pounds. On account of great depth and lower values, the Tamarack portion of the lode gives little or no profit at low prices of copper.

The Kearsarge lode is the copper-bearing amygdaloidal upper portion of a bed of porphyritic melaphyre. The melaphyre near the lode is a dark grey or brownish ophite, with large phenocrysts of feldspar, usually greenish labradorite. The lode itself is commonly a brownish amygdaloid, with numerous and large amygdules of calcite, quartz, red feldspar and green epidote. Some copper occurs filling amygdules; but much of it is in irregularly shaped forms, which have evidently replaced the rock. Much of the copper is closely and probably genetically associated with epidote.

At Calumet the Kearsarge amygdaloid lies about parallel to the Calumet lode, having a strike N. 33° E. and a dip to the northwest of 38°. Further north the lode curves off more to the east.



Mining Osceola Amygdaloid Lode, Calumet and Hecla Mine, Mich.

The lode is several miles in length, and is being mined for a continuous stretch of five miles at the Centennial, South Kearsarge, Wolverine, North Kearsarge, Allouez, Ahmeek and Mohawk mines. Further north it has been opened up on the Gratiot, Seneca and Ojibway properties. Further south the lode has been opened up on the Calumet and Hecla, Laurium, Osceola and La Salle lands.

The ore mined on the five mile stretch from Centennial to Mohawk yields from 13 to 25 pounds copper per ton. The richest portions are at the Ahmeek, where the 1910 average was 22.3 pounds, and at the Wolverine, where the average for the fiscal year 1910-1911 was 24.75 pounds refined copper per ton of ore stamped. At

the Wolverine the ore is unusually uniform in grade and the percentage of rock broken and not stamped is very small.

Mr. Finlay estimated in 1911 that the five leading mines on the Kearsarge lode will produce 63,600,000 tons of ore, yielding 986,000,000 pounds of refined copper.

The Baltic lode is the upper portion of a melaphyre low down in the Keweenawan series. The amygdaloid has commonly grey or brownish groundmass, and amygdules of white calcite. The denser part of the bed, the footwall trap, is a brown melaphyre with abundant spots of green chlorite. The mineable copper is not confined to the amygdaloid, and frequently makes well down into the trap, thus making the lode very wide in places. Narrow veins carrying sulphides and arsenides are found in the lode, but are of no consequence as ore.

At the Baltic mine the lode strikes N. 60° E. and dips 73° N. W. The dip is much steeper than that on any of the other lodes, and consequently the method of mining is different, and will be described later.

The width varies commonly from 15 ft. to 60 ft. In some places the lode is mined for a width of 80 or 90 ft. The thickness is in most places greater than 20 ft. and averages about 24 ft.

Fissures are numerous in the lode, and at some of the mines faults and soft seams cut across it at short intervals. Many of the fissures are filled with calcite, making conspicuous, though usually very narrow, white veins, running across the dark rock. Many others are filled with soft greenish and reddish material, chloritic, talcose or clayey. These soft seams have apparently resulted from crushing and slipping. Often in such ground, the lode is displaced many times in a short distance.

In all the mines on the Baltic lode, the system adopted is to break the rock for the full width and sort out the poor rock and use it to fill in the stopes. The sorted ore from the different mines in 1910 yielded 17.95 to 26.6 pounds copper per ton. At the Superior mine much of the copper is unusually fine, and so disseminated that sorting is difficult. The ore mined at the Superior in 1910 averaged, however, 22.64 pounds per ton. At the other mines the ore is more readily selected from waste.

The lode has not yet been explored to any great depth, and its possibilities have yet to be determined. Mr. Finlay estimated in 1911 that the lode will produce about 15,000,000 tons of ore, containing about 311,000,000 pounds of copper. In this estimate he did not assume that the deposits will continue to very great depth, and if the values persist to depths found on the other great lodes, this estimate will, of course, be far exceeded.

The Pewabic lodes are the productive amygdaloids of the Quincy mine, and are now being opened up at the Franklin Jr.

Instead of a single lode, there is, at the Quincy, a zone about 300 feet thick in which there are several lodes. These vary considerably in different parts of the mine. For the most part they run parallel to one another and are separated by trap. In places they come together. There is commonly one of the lodes that is better than the other and is known as the "main" lode. As the workings are continued this main lode becomes in places quite subordinate in importance to one of the "east" or "west" lodes. What is known as the main lode in one part of the mine is not called the main lode in another part. In places there are four parallel lodes being worked at once.

The beds, of which the lodes are the amygdaloid portions, are a series of dark grey feldspathic lavas, porphyrites, known locally as the "Ashbed" series. The amygdaloid shows chlorite, calcite, epidote, quartz, prehnite and native copper in a dark brown or grey groundmass. The trap is a fine, but distinctly grained, dark grey, porphyrite, spotted with small patches of green chlorite. The copper occurs to some extent as a filling in cavities, but most of it has evidently replaced the rock, and forms irregularly defined masses, large and small. The larger masses, giving so-called "mass copper," are more abundant than in most of the lodes. While most of the copper is found in the amygdaloidal part of the bed, a large quantity is also mined from irregularly defined portions in the wall traps. The lodes are crossed by a number of persistent calcite veins, but these are usually barren and in parts of the lode that are poor.

At the Quincy mine, the main lode is on the average about 10 feet thick, varying from 3 to 15 feet. The inclination, as with most of the lodes, becomes less with depth—at the surface being 54°, and at the lowest levels, over one mile down on the slope, about 38°. This low angle of dip is not found in the southern part of the mine, but only in the bottom levels of the northern part. At the Franklin Jr. mine the dip varies from 49° at surface to 43° at the 32nd level. The lodes strike N. 30° E., and on the Quincy have a length of about three miles. Some of the lodes were not worked in the upper levels but were opened in cross cuts at lower levels and first worked extensively at a depth of nearly one mile down on the dip. They have since been worked for many levels above that at which they were first found to be good ore, and will be worked at comparatively shallow depth.

The Pewabic lode has produced at the Quincy over 600,000,000 pounds of copper. Some unusually rich ore was taken from the territory between No. 2 and No. 6 shafts, in the upper 20 levels. The ore mined in recent years has averaged about 16 pounds per ton. Mr. Finlay estimated in 1911 that the Quincy would produce 200,000,000 pounds more.

Osceola Lode.—This is a brown amygdaloid, spotted and streaked with white calcite, which has been worked by the Osceola, Calumet & Hecla and Tamarack mining companies. On these properties it has a length of about 3 miles. It underlies and runs parallel to the Calumet conglomerate, striking N. 33° E., and dipping at the surface at Calumet at an angle of 38°. The width varies from 15 ft. to 100 ft., the ore coming from two horizons, designated as hanging wall and foot wall parts. The chief and most regularly shaped ore body is found at the upper part of the bed. This hanging wall lode averages about 9 ft. in thickness and is fairly persistent and well defined. Below it is commonly dense brown melaphyre of varying thickness, succeeded by another amygdaloid, in which are irregular shaped ore bodies. The footwall deposits are often richer and thicker than those at the hanging wall, but they are of more pockety character, and do not persist so regularly with strike and dip. In some places dip and hanging portions are continuous, and there the lode is very wide, 40 to 100 ft. There is usually 10 to 20 ft. of the so-called "vein trap" separating them. The amygdaloid encloses numerous lenticular masses of dense trap. Often a bar of trap cuts across the amygdaloid, and it has been frequently noticed that the amygdaloid on opposite sides of such bars is unusually rich in copper.

The copper in the lode is rather regularly distribut-

ed, and in good rock readily detected. Hence, a satisfactory selection can be made before breaking, and practically all rock broken is hoisted.

Mr. Finlay estimated in 1911 the future production of the Osceola lode on Calumet and Hecla property, at 23,000,000 tons, yielding 330,000,000 pounds copper. The production for 1910 averaged 15.82 pounds per ton. The Osceola lode is very easily milled and smelted and produces copper of exceptionally high grade. Most of the copper from this lode is treated electrolytically for the recovery of silver.

Gold Quartz Veins, Hollinger Mine

ASBESTOS.

Supplying as they do a large proportion of the world's consumption of asbestos, the Canadian deposits of this mineral are of particular interest. While occurrences of the mineral have been noted in other localities and provinces, the principal areas are those found in the Eastern Townships, Province of Quebec. The present workable deposits are—as far as exploration work has shown, and with the exception of the Danville quarries—confined to the great serpentine range which strikes through the townships of Broughton, Thetford and Coleraine. Leaving some scattered deposits in the townships of Wolfstown and Ireland out of consideration, the total length of this productive serpentine belt is twenty-three miles, with a width varying from 100 feet in the extreme easterly part to 6,000 feet in the Mock Lake area; however, the serpentine belt as a whole in many places far exceeds the width indicated above. Active mining began about 1880.

The principal deposits occur at Thetford, Black Lake, Danville, and East Broughton; those at Thetford and Black Lake being the most important. The mineral occurs in a series of narrow and irregular veins, occasionally attaining a width of six inches, though those of the larger size are comparatively rare. Veins with three or four inches of fine fibre were, in the first years of working, quite plentiful; but as the mines increased in depth these appear to decrease somewhat in size. The veins reticulate through the rock in all directions. The deposits are worked by open quarrying, the long fibred asbestos of the larger veins being readily separated out, while the smaller material is carefully cobbed. This separation was at first accomplished entirely by hand, but mechanical treatment has been gradually introduced and perfected until now large mills are in operation in which the rock is broken and crushed in various ways; and the fiberized asbestos taken up from screens by suction fans, and blown into collectors or settling chambers.

The annual production is now over 100,000 tons, valued at upwards of $3,000,000; and includes a wide variety of grades from the long fibred crude asbestos, valued at $300 a ton, down to the shortest mill fibre, valued at only $2 or $3 per ton, and "asbestic" sand used for wall plaster, and valued at from 75c. to $1.50 per ton.

COBALT ORE AND BULLION SHIPMENTS.

(Cobalt Nugget.)

Thanks to the shipment of three cars of ore from the McKinley-Darragh immediately prior to the annual meeting on Monday, the ore shipments last week, were well maintained. The Cobalt Townsite also contributed quite materially with a couple of cars. The Dominion Reduction continues to ship low-grade concentrates, their car this week going to Carnegie.

But the bullion shipments continue to be under what they were last year. The Nipissing's annual clean-up at the high-grade mill is now completed, and from this time forward the bullion shipments should attain to normal proportions.

The shipments from the Cobalt camp for the week ending February 20th, were:—

	High.	Low.	Tonnage.
Dom. Red.		87,900	87,900
Nipissing		132,040	132,040
McKinley-Darragh	203,810		203,810
Hudson Bay	86,160		86,160
La Rose	84,520		84,520
Cob. Townsite.	173,980		173,980
O'Brien	60,160		60,160
	608,630	219,940	828,570

The bullion shipments for the week ending February 20th, were:—

	Bars.	Ozs.	Value.
Dom. Red.	31	35,061.00	$21,984.77
Nipissing	26	31,754.76	18,338.37
Kerr Lake	3	2,266.00	1,162.00
	60	69,081.76	$41,485.14

BOOK REVIEWS

THE COPPER HANDBOOK—Vol. XI.—1912-1913—by Walter Harvey Weed—Mining World Co.—Price $5.00—for sale by Book Department Canadian Mining Journal.

This work, founded by the late Horace J. Stevens, of Houghton, Mich., has for some years been the standard work on copper mines. The new edition has been entirely written by Mr. Weed, a recognized authority on copper mining. A new feature is a geographical index, which gives at a glance the names of all mining companies operating in or near any town. The "dead" companies are separately listed.

The greater part of the book, as in former editions, is devoted to description of the copper mines of the world, and information concerning company holdings, officials, finances, costs, mine output, nature of ore, geology and methods of mining, milling and smelting. Plants are described. Predictions are made as to the future.

The work is in five parts, headed as follows: Detailed description of the copper mines of North America, including Canada, United States and Mexico; Geographical Index; Detailed description of the copper mines of foreign countries; Statistics; List of dead, merged, liquidated mining companies.

Mr. Stevens gathered and digested a great mass of information concerning copper mining companies in all parts of the world. In his Copper Handbook he gave this information in concise form. Mr. Weed has in revising the work drawn on a fund of technical knowledge, particularly of the mining districts of the United States.

THE MINING MANUAL AND MINING YEAR BOOK 1914—by Walter R. Skinner—Price $5—For sale by Book Department Canadian Mining Journal.

This volume is the twenty-eighth of the series. The first was published in 1887. The work is classified into two sections—"African" and "Miscellaneous." While most of the mines listed are those whose shares are dealt in on the London market, there are many others. Particulars are supplied of 2,620 companies, and the Index gives references to 5,220 companies.

In most cases an analysis of the last balance-sheet is provided. A statement is made of dividends from inception, ore reserves, output, description and capacity of plant, results of exploration, etc.

Alphabetical lists of mining directors, secretaries, engineers and mines managers, with their addresses and the names of the companies with which they are connected, is included.

The work has been for years a standard reference on mines. The 1914 edition brings it up-to-date.

THE ELECTRIC FURNACE—by Alfred Stansfield, D.Sc., Birks Professor of Metallurgy in McGill University—Second Edition, Revised, Enlarged and Reset—McGraw-Hill Book Co., 1914—Price $4—For sale by Book Department Canadian Mining Journal.

The first edition of this book was published in 1907. During the past few years development has been rapid, and the new edition is much larger by the inclusion of new material.

The chapter headings are: History of the electric furnace; Description and classification of electric furnaces; Efficiency of electric and other furnaces and relative cost of electrical and fuel heat; Construction and design, operation of electric furnaces; Laboratory furnaces; The production of pig iron in the electric furnace; The production of steel from metallic ingredients; The production of steel from iron ore; The ferro alloys and silicon; Graphite and carbides; The electric smelting of zinc and other metals; Miscellaneous uses of the electric furnace; Electrolysis and electrolytic processes; Future developments of the electric furnace.

The author endeavors to trace the evolution of the electric furnace from its simplest beginnings, and to set forth the more important facts relating to its theory and practice. He believes that while a few years ago it was a scientific curiosity, it now threatens to rival the Bessemer converter, the open-hearth steel furnace, and even the blast furnace itself. The book is well written, well illustrated and well printed.

DOMINION STEEL AND COAL.

Feb. 23.—"The improvement in the steel industry in Canada has not been nearly as rapid as we had expected early in the winter and the improved conditions which we had looked for with the coming of spring may be withheld until the summer."

This was the view expressed by Mr. J. H. Plummer, President of the Dominion Steel Corporation, while in Montreal on Saturday en route from Sydney to Toronto.

"Orders have neither been as large or as numerous as we had expected, and while the steel plant is working on about two-thirds time, the only work being done is on rail orders and these are almost solely for export business," explained the Steel President.

Referring to the coal business, Mr. Plummer said that there had also been a noticeable falling off in this business during the present winter and at the present time the mines were engaged in mining for next summer's orders.

Speaking of the reported sale of a large quantity of ore from the Wabana Mines, Mr. Plummer said negotiations had been entered into for the sale of a quantity of this ore, but he was unable to estimate what the profits, resulting from the sale, would be.

Mr. Plummer is leaving in March for England. He said that it was purely a vacation and not for any business connected with the company. In some quarters his projected visit abroad was associated with the intention of marketing the unsold portion of their authorized note issue.—Montreal Star.

NIPISSING.

Cobalt, Feb. 25.

A new bullion record for the Cobalt camp was established to-day, when the Nipissing mines shipped nearly 13 tons of silver, valued at more than a quarter of a million dollars, in 381 bars. The shipment contained 452,335.87 ounces, and was valued at $260,681.16. It goes by train to Halifax, and leaves by the Alsatian from that port for England on Saturday morning.

The camp's previous record was established in January of last year, when 265 bars were shipped during the week by several companies in camp, and at that time Nipissing led with nearly 200 bars.

PERSONAL AND GENERAL

President A. E. Barlow and Secretary H. Mortimer-Lamb represented the Canadian Mining Institute at the A.I.M.E. banquet on Wednesday, Feb. 18th.

Mr. W. E. Segsworth has returned to Toronto from London, England.

Mr. J. B. Tyrrell attended the annual A. I. M. E. meeting in New York, and has returned to Toronto.

Mr. W. W. Mein has returned to New York, after spending two weeks at Porcupine.

Mr. F. H. Hatch is in Canada to examine properties at Kirkland lake for the K. L. Exploration Co.

Mr. Eugene Coste, of Calgary, was in New York last week, and presented a paper on Origin of Petroleum, at the A.I.M.E. annual meeting.

Mr. W. P. Alderson, general manager of the Motherlode Sheep Creek Mining Co., operating a gold mine and stamp-mill in the Sheep Creek region of Nelson mining division, left British Columbia last month, on a visit to Montreal.

Mr. J. J. Fingland, of Kaslo, B.C., has been appointed assistant assayer in connection with the experiments in electric smelting of lead-zinc ores being carried on at Nelson, B.C., under the direction of Mr. G. C. Mackenzie of the Mines Branch, Canada Department of Mines.

Capt. Harry Johns, superintendent of several mines of the British Columbia Copper Co., operating in Nelson and Slocan mining divisions, British Columbia, has gone to California to recuperate after a serious illness with pneumonia.

Mr. Frederic Keffer is back in the Boundary district of British Columbia from a visit to Cleveland, Ohio, and New York City, N.Y.

Mr. Arthur Lakes, Jr., manager for the Ymir-Wilcox syndicate, which for about two years has been developing the Wilcox mine, near Ymir, B.C., has been spending a winter vacation in California.

Mr. Robert C. Sticht, recently arrived at Vancouver, B.C., from Tasmania, where for some years he has been general manager for the Mount Lyell Mining & Railway Co. He did not remain on the coast, but at once proceeded East.

Mr. John Shanks, of Fernie, B.C., has resigned as colliery manager for the Crowsnest Pass Coal Co., to accept a position with the Brazeau Colliery Co., having extensive coal-land holdings situated in western Alberta.

Dr. Otto Sussman, of New York, has been on a visit to West Kootenay, British Columbia, whence he went to Butte, Montana.

Mr. R. E. Hore has returned to Toronto from New York, where he attended the A.I.M.E. annual meeting.

Mr. R. Randolph Bruce, of Invermere, East Kootenay, B.C., was married in England, in January, to Lady Elizabeth Northcote. He is well known in British Columbia, having resided in the vicinity of the head of the Columbia river for about 16 years. He was manager of the Paradise mine, in Windermere mining division, when that property was being worked some years ago.

Mr. Geo. B. Burchell, former general manager of the Maritime Coal Ry. & Power Co., of Nova Scotia, has opened an office in the McGill Building, 211 St. James street, Montreal. Mr. Burchell, who is a graduate of McGill University, has spent the last 14 years in colliery management in Eastern Canada. He recently returned from Europe, where he has been carrying on certain mining investigations for the Saskatchewan Government.

Mr. Roscoe Wheeler, superintendent of the Hedley Gold Mining Company's 40-stamp mill and cyanide plant in Similkameen district, British Columbia, who last month returned from a month's visit to California, has been recalled to that state, owing to the serious illness of his mother.

Mr. A. J. Young has been elected Chairman of the Associated Boards of Trade of Ontario.

Mr. R. R. Shafter, formerly sales engineer of the Traylor Engineering & Manufacturing Co., of New York, has recently been appointed manager of the mining, crushing and cement machinery department of the Jenckes Machine Company, with headquarters at Sherbrooke. Mr. Shafter is a graduate of Stephen's Institute and a member of the American Society of Mechanical Engineers. He is bringing with him to the Jenckes Machine Company several engineers who are experts in the construction and installation of mining machinery and are thoroughly familiar with the class of work Mr. Shafter had charge of in his former position.

Mr. J. H. Plummer has returned to Toronto after visiting the Nova Scotia properties of the Dominion Coal and Steel Companies.

Mr. J. H. Fairbank, of Petrolea, Ont., well-known as an oil producer, died last week in his 83rd year. He was for over 50 years prominent in the oil industry.

Mr. A. A. Hassan has concluded an examination of placer gold deposits in Arizona and returned to Brooklyn, N.Y.

Herbert Morris, Limited, has just received from the London and North Western Railway Company, an order for ten 10-ton hand overhead traveling cranes and two electric cranes. This, together with an order for eight 12-ton hand-cranes, from the London and South Western Railway Company, makes the largest contract of the kind that has been placed for some years past.

NEW HOIST FOR BEAVER MINE.

Cobalt, Feb. 25.

The new hoist of the Beaver Consolidated mines, which will hoist from a depth of 2,000 ft., has arrived in camp, and is now being unloaded from the car at the Kerr Lake station. The hoist is the largest one in camp, and will permit the policy of deep mining planned by the company some months ago. As soon as the hoist is installed at the mine, work will immediately start in sinking below the present levels.

For some months past no work has been done on either the 700 or 800-ft. levels because the hoist at present in use at the mine would not accommodate these levels satisfactorily. Several hundred feet of drifting was done at 700 ft. with good results, but at 800 ft. work accomplished did not reach the ore shoot on the main level. The work on both these low levels will immediately be resumed once the new hoist is running at the mine, and, in addition, drills will start sinking to open a level at 900 ft. Levels will be opened each 100 ft. on the way down and the favorable development of each level will mean additional depth to the property.

SPECIAL CORRESPONDENCE

COBALT, ELK LAKE AND GOWGANDA

Nipissing.—In view of the sudden recession in the position of Nipissing, the monthly report was of especial interest. The production was $186,459—much less than usual—but this is explained by the fact that this is the month of the annual clean-up at the high grade mill. Only 22 tons were treated there during the month. Structural improvements were also a contributing cause to the relatively small output at the high grade mill during the month. No new veins were actually encountered during the month, but some finds made in the previous month are reported to be developing finely. At the present time the drift face on the Meyer vein, which has a total length on four levels of over 1,100 ft., show three veins averaging 2,000 oz. over a width of 1 in. and one vein assaying a like amount 2 to 4 in. wide. The Meyer vein, which follows the contact with the Keewatin formation down, will contribute good ore for a hundred feet above the contact between the Trethewey boundary and the east face of the drift on the fourth level. The mill ore, apart from the high grade, runs about 20 oz. across 15 ft. In the crosscuts from shaft No. 73 new veins were found. At shaft 64 drifting was continued on the new vein encountered on the third level two months ago. During most of the month the west drift showed two in. of ore averaging 2,000 oz. This vein has now been drifted on at this level for a distance of 150 ft., and will average 1½ inches wide, and will assay 1,800 oz. Work on the original cross-cut, which is to connect shafts 73 and 64, has been resumed. The connection has now almost been made.

On the other side of the lake most of the work was confined to the Little Silver vein. The vein was stoped from the 24 ft. level, producing high grade ore assaying 2,500 oz. over a width of two in. A branch vein over a width of two in. is producing 500 oz. ore. During the month the low grade mill treated 6,023 tons.

The diamond drill has now been moved to the southern shore of Peterson lake, where more interesting results are anticipated.

Peterson Lake.—The discovery on the Peterson Lake property was made from the old shaft of the Kerry lease, which some time ago reverted to the Peterson Lake Mining Company. The old crosscut on the Kerry was used for 200 ft. south of the shaft, when work was commenced in an old drift 100 ft. away from the crosscut to the east. This drift was on a vein showing plenty of cobalt, but very small silver values. It was entirely in the Keewatin formation. Twenty or thirty feet of work carried the company into conglomerate rock, when almost at once the high grade ore was struck. There are two veins in the drift, and it is stated that the wall rock will make good milling ore. Drifts will be driven on both veins. A crosscut will also be commenced from the old St. Anthony lease to connect with the present drift from the old Kerry. A very extensive scheme of development had been planned by the Peterson Lake. It is intended to connect the shaft at the Narrows with No. 1 shaft of the Kerry and the No. 1 shaft with the main workings of the Kerry and crosscuts to that end have already been commenced. It is remarkable that before the Seneca-Superior took over the lease on Cart Lake, the Kerry Mining Company had it, as they also held the lease on Peterson Lake, where the strike has now been made.

On the Porcupine Winter Trail in 1910

Trethewey.—The outstanding feature of the annual report of the Trethewey Silver Cobalt mine is that while ore reserves stand almost where they did a year ago the net silver produced amounted to $333,611, while the gross revenue for the year was $334,769. The operating expenditures amounted to $204,072, leaving a net revenue from operations of $130,696, as compared with $127,834. This must be regarded as very satisfactory, since the high grade days of the Trethewey are over.

Dividends paid during the past year amounted to $150,000, and after all provision had been made, the surplus carried forward to the current year was $146,148.

The report of Mr. D. L. H. Forbes, consulting engineer for the property, showed that the total amount spent on development during the year was $37,686, for which a total footage of 20,984 was made.

The estimate of silver in the ore reserves was 29,-928 tons, containing 585,970 oz.

To make the mill more efficient $5,598 was spent, and as a result the tonnage milled was 32.1 per cent. greater and the cost 25.2 per cent. less.

The total silver produced was 619,427 oz., but of this only 599,035 oz. were shipped.

An operating profit of $130,696, or $3.70 per ton, was made during the year. From this had to be deducted $3,757 spent on exploration work at the West Beaver mine, and the net profit for the year was $126,939.

Of the prospect taken up near Port Arthur—the West Beaver mine—it is stated that the property is being worked on a working option basis. The vein is stated to be three ft. wide, 26 ft. below the adit level, and not sufficient work has been done yet to block out any ore or to warrant any estimate of ore in sight.

A New Mineral.—T. L. Walker, professor of Mineralogy at the University of Toronto, announces that he has discovered a new mineral in some ore samples from the Moose Horn mine at Elk Lake, and he has named it "Temiskamite." It was sent to the royal Ontario Museum of Mineralogy as niccolite, but is in reality much paler in color. It occurs in calcite veins carrying niccolite and smaller amounts of native bismuth and silver.

City of Cobalt.—A discovery of considerable importance has just become generally known on the City of Cobalt. A vein of very high grade ore has been cut near the Coniagas boundary at the 200 ft. level. Twenty stamps are now dropping on City of Cobalt ore at the Cobalt reduction mill. Most of this ore is coming from No. 14 vein at the 400 and 330 ft. levels.

Reeves-Dobie.—A Toronto syndicate has taken a 90-day option on Mr. S. J. Dobie's half interest in the Reeves-Dobie claims at Gowganda. They will commence work at once.

Beaver.—High grade silver is being mined in granite at the 460 ft. level of the Beaver mine. The granite is an intrusion in the Keewatin. In the 15 ft. the drift has been pushed the vein will average from four to six in., and will probabaly average 3,000 oz. to the ton.

This is the first time that silver has been discovered in granite in the camp.

PORCUPINE, SWASTIKA AND KIRKLAND LAKE

Dome Lake.—The report of the new manager of the Dome Lake mine, submitted to shareholders at the annual meeting, stated in regard to ore reserves that there were two ore shoots on the 180 ft. level, one 60 ft. long, of an average width of 20 in., assaying $17.96, the second 50 ft. long of an average width of 20 in. assaying $18.80 per ton. The ground between the two ore shoots will be productive. On the 150 ft. level one lens has been drifted on for 100 ft. of vein matter, carrying an average assay of $22.80 per ton. The ore still shows in the face of the drift.

Mr. A. H. Brown plainly intimates that previous work was not well directed. Although 4,646 ft. of work had been done, only 926 ft. was in ore. The greater portion of the drifting and crosscutting had been run in the most erratic manner.

As to the mill it was not proposed to go to the expense of making alterations until the mine had been developed sufficiently to allow of an estimate of the tonnage and grade of ore to be made.

The average value of ore sent to the mill was $8,976. The lower value shown was largely due to the fact that much waste went to the mill, there being no facilities provided for picking the same before it went to the mill. The mill crushed 3,717 tons of ore in the three months it was operated, during which time there was recovered $25,369.

Mr. A. H. Brown is hopeful that six months' work will develop sufficient ore to enable the mill to be operated continuously on a 50 ton a day basis, and that the ore should be a much better grade than treated in 1913.

The directors decided to raise the capitalization to $1,000,000, and offer the 250,000 extra shares at 30 cents a share. It was also decided to move the head office from Toronto to New Liskeard, where the bulk of the stock is now held.

More Kirkland Lake Claims Sold.—Several more sales are reported of Kirkland Lake claims to English syndicates. Perhaps the most important of these is that of the Kirkland Lake Gold Mines, in which Mr. A. G. Bagshaw, J. H. Black and other Haileybury men are mainly interested. Satisfactory terms have been offered, and Mr. W. A. Gordon, of Haileybury, has left for London to complete the deal.

Dome.—According to statistics submitted, the average value of Dome ore for the past ten months has been $8.86. This compares with $8.02 for January. The month of January showed an all round improvement in the tonnage milled and the gold per ton recovered. Since April of last year the Dome reports 118,230 tons milled, gold recovered $1,047,606.

Dane.—In the month of January shipments from the Dane Mining Company were resumed. Three shipments from Dane station were made of copper ore, in all totalling 132,900 lb. From South Porcupine 69,000 pounds of gold ore was shipped from the Porphyry Hill property. This ore is coming from an open cut on the old claims of the Preston East Dome, which reverted to and are now being worked by the original owners.

Alexo—The little nickel mine near Porquis Junction known as the Alexo mine, continues to make very considerable shipments. During the month of January alone twenty cars were shipped, carrying in all 1,489,-350 lb. to the new Mond Nickel Company's smelter at Coniston, Ont.

BRITISH COLUMBIA

In the chief producing districts, of lode metals and coal, there is much activity. The year has opened auspiciously, and the outlook at present is favorable to a year of large production, and of profit-earning to a greater extent than in 1913, which year was the best from a dividend-paying point of view the mines of the Province have had for a comparatively long time.

Trail.

Consolidated Mining & Smelting Co.—Statistics now available show that the total quantity of ore and concentrates received at the Consolidated Mining and Smelting Co.'s smeltery at Trail during the calendar year 1913 was 353,502 tons gross, or 348,201 tons net.

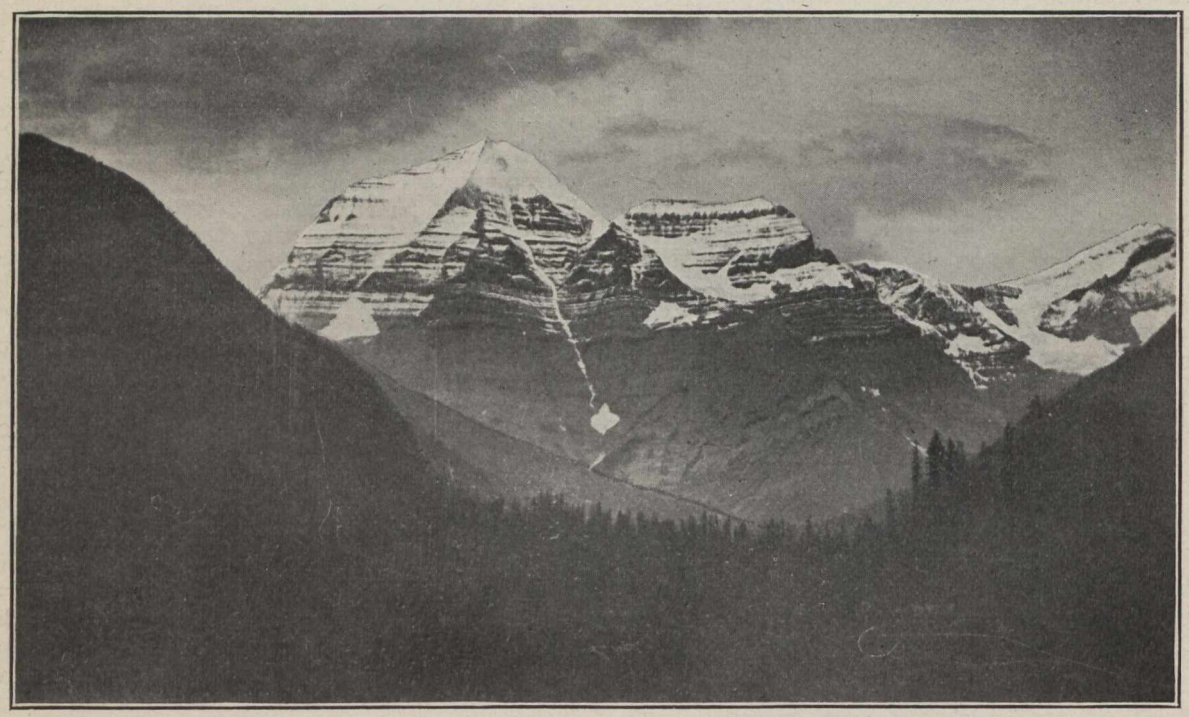
The production of metals was as follows: Gold, 149,946 oz.; silver, 2,860,890 oz.; lead, 48,495,694 lb.; copper, 2,613,568 lb. of that quantity of ore, 23,558 tons was from Washington and Idaho mines; this yielded 14,667 oz. of gold, 160,313 oz. of silver, 195,037 lb. of lead, and 354,105 lb. of copper. The Washington mines that shipped to Trail were as follows: Republic camp —Ben Hur, 16,542 tons; Knob Hill, 1,442 tons; Lone Pine, 924 tons; Hope, 912 tons; Surprise, 485 tons; Imperator-Quilp, 196 tons; miscellaneous, 9 tons; total from Republic, 20,510 tons. Other Washington mines —United Copper at Chewelah, 2,076 tons; Bononza at Evans, 575 tons; four smaller shippers, 44 tons; total for Washington, 23,205 tons. Idaho shipments totalled 353 tons, chiefly from the Snowstorm mine, Larson.

British Columbia mines shipped 329,944 tons of the before-mentioned total. This came from the districts as follows: East Kootenay, 34,571 tons; Ainsworth, 14,974 tons; Slocan, 21,569 tons; Nelson, 12,084 tons; Rossland, 240,442 tons; Lardeau and Trout Lake, 557 tons; Boundary, 4,807 tons; Kamloops and Nicola, 612 tons; Coast, 328 tons.

The proportion from the company's own mines was 267,940 tons, or 75 per cent. of the total; this included Centre Star-War Eagle and Le Roi groups at Rossland 218,164 tons, St. Eugene and Sullivan in East Kootenay district 34,355 tons, No. 1 and Highland in Ainsworth camp 5,147 tons, Molly Gibson and Silver King in Nelson mining division 4,737 tons, No. 7 in Boundary district, 4,594 tons, and Ottawa and Richmond-Eureka in Slocan district 943 tons. Custom ores totalled 85,562 tons—23,558 tons from the United States, as detailed above, and 62,004 tons from British Columbia mines. Shippers of more than 200 tons each were as follows: Ainsworth division—Bluebell (concentrate), 7,209 tons; Silver Hoard, 1,286 tons; Utica, 626 tons; J. L. Retallack & Co.'s Whitewater group, 517 tons. Slocan division—Standard (ore and concentrate), 14,390 tons; Rambler-Cariboo (ore and concentrate), 3,160 tons; Van Roi (concentrate), 584 tons; Slocan Star, 479 tons; Ruth, 470 tons; Eastmont, 336 tons; Idaho-Alamo, 275 tons; Silverton Mines, Ltd. (Hewitt-Lorna Doone mines), 232 tons; Surprise, 221 tons. Nelson mining division—Yankee Girl, 3,034 tons; Emerald, 1,149 tons; Queen (gold ore concentrate), 608 tons. Rossland mines—Le Roi No. 2 Co.'s Josie group, 22,002 tons (first-class ore, 20,359 tons and concentrate 1,643 tons); Lardeau-Ferguson Mines, Ltd., 525 tons. Kamloops—Iron Mask, 585 tons. Skeena district (Coast)—Silver Standard, 282 tons. In all 103 mining properties shipped to Trail, as follows: From East Kootenay 4, Ainsworth 12, Slocan 31, Nelson 14, Rossland 8, Lardeau 5, Boundary 7, Kamloops 1, Nicola 1, Skeena district 5, United States 15.

Kamloops.

The Kamloops Copper Co., of Duluth, Minnesota, after having for some time held the Iron Mask group without doing work on it, during 1913 shipped ore from the Erin claim of the group and put in electrically operated machinery to run the plant at the Iron Mask 600-ft. shaft. There was received at Trail from this property in 1913 585 tons of ore, and it is expected that a larger output will be made after the new machinery shall be in use and it shall be practicable to resume mining in the Iron Mask mine.



Mount Robson, B.C.

Mr. W. M. Brewer, who spent some time in Kamloops mining division investigating mining conditions, says: "On the North Thompson river, some deposits of gold-bearing quartz were opened during the year which may be developed into successful mines; as these locations are situated near the Canadian Northern Railway, they are easy of access. On the Cotton Belt group, in Seymour Arm camp, some of the ores contain copper in a quartz gangue and others galena in a magnetite gangue. These locations at present are handicapped by lack of transportation facilities. Some

prospecting was done during the past summer on Louis creek, a tributary of the North Thompson, and it is claimed that about $8,000 in placer gold was recovered by individual miners. The bedrock is deep and only exposed at one point. This creek was worked for gold as early as 1862."

Lillooet.

In the Bridge River section of Lillooet district the most important recent development was that of the Coronation Gold Mines, of Victoria, which company, after having acquired the Ben d'Or property and having done a lot of underground work, repaired the old 10-stamp mill and crushed 840 tons of ore, from which was recovered 1,368 oz. of gold and 295 oz. of silver, beside 20 tons of concentrate stored for shipment later. A few men have been kept employed through the winter sinking a winze from the lowest tunnel (No. 4).

	1911-1912.	1912-1913.
From free miners' certificates..	$ 68,101.21	$ 62,985.70
From mining receipts, general..	93,461.70	94,754.35
From mineral tax	100,659.29	155,163.36
From royalty and tax on coal..	195,207.78	302,225.35
From unworked Crown-granted mineral claims	43,436.00	42,733.43
From Bureau of Mines	662.50	863.00
	$501,528.48	$658,725.19

HOLLINGER.

The regular twenty-eight-day statement of the Hollinger Gold Mines, Limited, for the period ending January 28 shows a decrease in the gross profits to

Members of C2 Excursion, on Grand Trunk Pacific near Swiftwater, B.C. Mount Robson in the Background.

The Pioneer mine, also on Cadwallader creek, has been examined and sampled for the owners, and some development work is being done. The completion of a wagon road from Seton lake to the Pioneer has made it practicable to work mineral claims on Cadwallader at much less cost than when everything had to be packed in to the properties.

Not much placer mining was done last season, though the Golden Dream Co. did some prospecting on its leases on Cadwallader creek. Some ground-sluicing was done with the object of exposing the leads on the Blackbird claim, and a crosscut was driven 100 ft. to one vein and about 100 ft. of drifting done on it.

Victoria.

The Public Accounts of the Province show that the revenue for the last two fiscal years included the following from mining:

$101,603, as compared with $114,000 in the previous period. The average value of ore hoisted shows a decrease from $16 to $13.57 per ton, but there was a small reduction in working costs. The profits of the Hollinger mine have been decreasing steadily for some months owing to the development work now in progress, and the fact that the grade of ore hoisted has been steadily lower.

The present report is signed by Mr. A. R. Globe, the assistant general manager, Mr. P. A. Robbins, the manager, being at present on a holiday abroad.

It is stated in the report that during the period covered 1,179 ft. of diamond drilling was accomplished, locating one new ore body on the 425-ft. level and on the 200-ft. level. General development amounted to 817 ft. In the month 2,912 tons were taken from development and 9,943 tons from the stopes.

MARKETS

STOCK QUOTATIONS.

New York Curb.

Quotations and transactions on the New York Curb reported by Erickson, Perkins & Co. (J. G. Beaty), are as follows:

Feb. 24, 1914.

	Bid.	Ask.
Buffalo	.01 11/16	.01 7/8
Dome Mines	.16 3/4	.17 1/2
Foley-O'Brien	.15	.20
Granby	.85 1/2	.86
Hollinger	.17	.17 1/2
Kerr Lake	.04 15/16	.05
La Rose	.01 11/16	.01 15/16
McKinley	.01 3/16	.01 1/4
Nipissing	.06 3/8	.06 1/2
Rea Cons	.00 1/8	.00 1/4
Preston	.01	.02
Pearl Lake	.09	.11
Silver Leaf	.01	.03
Silver Queen	.01	.03
Swastika	.08	.12
Porcupine Gold (Vip.)	.02	.05
Trethewey	.28	.30
Yukon Gold	.02 1/2	.03 3/4

Porcupine Stocks.

(J. P. Bickell & Co.)

Feb. 23.

	Bid	Ask.
Apex	.01 7/8	.02
Dome Extension	.10 3/4	.11
Dome Lake	.34	.35
Dome Mines	12.00	17.25
Foley-O'Brien	.16	.18
Hollinger	16.80	17.00
Jupiter	.12 1/2	.13
McIntyre	1.30	1.35
Moneta	.02	.04
North Dome	.20	.25
Northern Exploration	2.80	3.00
Pearl Lake	.09 3/4	.10
Plenaurum	.45	.60
Porcupine Gold	.13 1/2	.14
Imperial	.02 1/4	.02 1/2
Porcupine Reserve	...	.06
Preston East Dome	.02	.02 1/8
Rea	.15	.25
Standard	.01	.01 1/2
Swastika	.04	.04 1/4
United	.01	.01 1/2
West Dome	.09	.10
Porcupine Crown	1.27	1.30
Teck Hughes	.20	.30

Cobalt Stocks.

(J. P. Bickell & Co.)

Feb. 23.

	Bid	Ask.
Bailey	.05	.05 1/4
Beaver	.29	.30 1/2
Buffalo	1.80	2.00
Canadian	...	.10
Chambers Ferland	.21	.22 1/2
City of Cobalt	.40	.50
Cobalt Lake	.68	.72
Coniagas	7.90	8.25
Crown Reserve	1.80	1.84
Foster	.10	.10 1/2
Gifford	.03	.03 1/2
Gould	.03	.03 1/4
Great Northern	.14	.14 1/4
Hargraves	.02	.02 1/2
Hudson Bay	71.00	73.00
Kerr Lake	4.80	4.90
La Rose	1.72	1.75
McKinley	1.19	1.20
Nipissing	6.40	6.50
Peterson Lake	.41	.41 1/2
Right of Way	.06	.06 1/2
Rochester	.03	.03 1/4
Leaf	.02	.02 1/2
Cochrane	...	.40
Silver Queen	.04	.05
Timiskaming	.22	.22 1/2
Trethewey	.25	.28
Wettlaufer	.05	.07
Seneca Superior	2.85	3.00

TORONTO MARKETS.

Feb. 24.—(Quotations from Canada Metal Co., Toronto):
Spelter, 5¼ cents per lb.
Lead, 5¼ cents per lb.
Tin, 41 cents per lb.
Antimony, 8½ cents per lb.
Copper, casting, 15½ cents per lb.
Electrolytic, 15¼ cents per lb.
Ingot brass, 10 to 15 cents per lb.

Feb. 25.—Pig iron—(Quotations from Drummond, McCall & Co., Toronto):
Summerlee No. 1, $26.00 (f.o.b. Toronto).
Summerlee No. 2, $25.00 (f.o.b. Toronto).

Feb. 25.—Coal—(Quotations from Elias Rogers Co., Toronto):
Anthracite, $8.25 per ton.
Bituminous, lump, $5.25 per ton.

GENERAL MARKETS.

Coke.

Feb. 20.—Connellsville Coke (f.o.b. ovens):
Furnace coke, prompt, $1.90 per ton.
Foundry coke, prompt, $2.40 to $2.60 per ton.

Feb. 20.—Tin, straits, 39.25 cents.
Copper, Prime Lake, 14.80 to 15.00 cents.
Electrolytic copper, 14.55 to 14.65 cents.
Copper wire, 15.75 to 16.00 cents.
Lead, 4.00 cents.
Spelter, 5.40 to 5.50 cents.
Sheet zinc (f.o.b. smelter), 7.25 cents.
Antimony, Cookson's, 7.25 cents.
Aluminum, 18.50 to 18.75 cents.
Nickel, 40.00 to 45.00 cents.
Platinum, hard, 10 per cent., $46.00 to $47.50 per oz.
Paltinum, hard, 20 per cent., $49.00 to $51.50 per oz.
Platinum, soft, $43.00 to $44.00 per oz.
Bismuth, $1.95 to $2.15 per lb.
Quicksilver, $38.00 per 75-lb. flask.

SILVER PRICES.

	New York. cents.	London. pence.
Feb. 10	57½	26 9/16
" 11	57½	26 9/16
" 12	..	26 5/8
" 13	57 3/8	26½
" 14	57 3/8	26½
" 16	57 3/8	26½
" 17	57 3/8	26½
" 18	57 3/8	26½
" 19	57½	26 9/16
" 20	57½	26 9/16