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The Canadian Mining Journal

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CIRCULATION.

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CONTENTS.

GOWGANDA TO-DAY.

We recommend to our readers the article "Gowganda" that appears in this number of the CANADIAN MINING JOURNAL. It is written by Mr. G. M. Colvocoresses, who is manager of one of the successful mines of that neglected district, and who has been responsible from the first for the development of the mine that he superintends. Mr. Colvocoresses speaks with the temperance that is born of experience.

Perusal of the article leads to the conviction that to dub Gowganda a failure is unwarranted and unfair. Gowganda's good name was almost fatally wounded by fakirs and fools. Moreover, Gowganda has been injured by quite absurd comparison with Cobalt. As Mr. Colvocoresses points out, Gowganda is not, and may never be, in the same class with Cobalt. But Gowganda promises to make a respectable younger sister.

One important point dwelt upon in the article refers to the mistake of looking upon Gowganda as being solely a high-grade camp. "A very considerable quantity of milling ore assaying from 30 to 100 ounces of silver per ton is now being developed," says Mr. Colvocoresses. Further, he affirms his belief that the greater part of Gowganda's production will eventually come from mills treating comparatively low-grade rock, which is excellent concentrating ore.

This fact bears essentially upon the future of the camp, and is surely full of meaning. Given the assurance of large reserves of low-grade milling ore, a railway into Gowganda becomes perfectly feasible. At present it is out of the question to move large quantities of freight into or out of the camp. The erection of mills must be postponed, therefore, until such time as a railway is built. We believe that the Ontario Government cannot long refuse to guarantee the construction of a railway. Or, rather, we may reasonably assert that the Government will be glad of good cause to take action. It looks not unlikely that good cause can be shown.

The story of Gowganda accentuates one basic truth. That truth is that in the selection, in the development, and in the operation of mining properties, level-headed competent men are needed. Never was illustration so complete, nor contrast so startling. A collateral truth is that competent men must take some measures to protect first the camp and next themselves from the reproach brought on all by the unrighteous. Gowganda lost years of growth through the reckless cupidity of the get-rich-quick class.

Quite by-the-way, our readers must not imagine that Gowganda is a land of perpetual snow. It is a sad fact that most of our photographs are taken during the

winter. In summer, luxuriant foliage springs up and blocks the camera.

To the careful, vigorous and sustained efforts of a few mine managers Gowganda owes its present healthy condition. These men we congratulate.

PRACTICAL CONSERVATION.

The Nova Scotian Department of Mines has issued a statement form that is designed to furnish a complete yearly record of the extent of the coal mining operations conducted by each colliery. The form is designated "Coal Depletion Statement." The items are sufficiently inclusive to show the amount of coal mined, the reserves developed, the amount of coal remaining in old workings, the tonnage recoverable, the percentage of extraction, and the total area worked over. Each manager will be compelled to fill in this form.

The commercial value of this step can hardly be overestimated. Not only does it provide means for forming a close annual estimate of actual coal reserves, both old and new, but it also will remove many erroneous conceptions as to the status of Nova Scotian collieries. Particularly this will be true of certain Cape Breton collieries, whose areas are mainly submarine.

One of the first revelations that will be brought out by "Coal Depletion" returns will be the fact that in many collieries there are enormous quantities of available coal remaining in old workings. There are areas, in fact, where, in old workings, the remaining recoverable coal exceeds the quantity extracted. An estimate of this class of reserves is vitally important.

Much light will be thrown upon the applicability of methods used. The determination of the percentage of coal loss or not recoverable will afford a fair standard of comparison between simlarly conditioned collieries. Here, however, we would suggest that the item, "Percentage loss or not recoverable," be divided into two distinct, and not alternative, items. The reasonableness of this suggestion is obvious.

As we present herewith a reproduction of the "Coal Depletion Statement," further comment upon the form is not needed. But it is appropriate to urge upon the

Coal Depletion Statement.

.....Company.....1909.....Year

ITEMS	QUANTITY
Average thickness of Coal Seam in feet	
Angle of dip	
Area worked over during year	
Total quantity, by calculation in tons, in Area worked over during year	
Quantity extracted in tons from Area worked over during year	
Percentage of quantity extracted from Area worked over during year	
Quantity in tons remaining in " " " "	
" " recoverable " " " " "	
Percentage loss or not recoverable " " " " "	
Total area in acres worked over in the Colliery at close of 1906	
" " " " " " " " " " " " 191	

Name or No. of Colliery.....

Name of Coal Seam.....

System of working.....

Total Area proposed to be worked from.....Colliery.....

Remarks

other coal-producing provinces the exigent need of following in Nova Scotia's steps. They will thus be advancing in a practical and useful manner the work of conserving our natural resources. The word "conservation" is limited arbitrarily by the unthinking to apply merely to nature untouched by man. But the one great lesson that all of us must learn is the duty of using properly what we actually possess. Nova Scotia has mastered the alphabet.

AMERICAN LABOUR UNIONISM IN CANADA.

That American labour unions are losing ground in Canada is patent. It follows, naturally, that home-made labour unions are gathering strength. But the most pregnant fact is that there is now definitely declared opposition to the invasion of Canada by American labour organizations.

For this the costly strike forced upon the employees of the Dominion Coal Company may be thanked. In this strike loud-mouthed agitators from the other side, aided by irresponsible local disturbers of the peace, attempted to gain absolute control of the workmen and to destroy the purely Canadian organization, the P. W. A. In this attempt they failed. Their methods could not carry them to lasting success. They appealed not to the loyalty and decency of the men, but to their cupidity. And good resulted from evil, for the P. W. A., a body deserving of confidence and respect, fought a good fight and emerged strong and confident.

To those who watch current events it would seem a national calamity were American unionism ever to dominate Canada. We are quite capable of conducting our own affairs. If we may judge by a comparison of the U. M. W. A. with the P. W. A., it is obvious that our labour leaders are saner and wiser citizens than any of their foreign opponents.

MINERS' PHTHISIS.

The report of the South African Mining Regulations Commission states that while the death rate among surface and underground white mining males in the three years, 1905, 1906 and 1907, was comparatively low, yet this low death rate concealed a very high mortality among a limited class of white rock drillers. The death rate among mining males is 60 per cent. higher than among those who are not constantly underground. Miners' phthisis (silicosis) carries off six times more underground workers than surface employees. The exact figures of underground death rates are not obtainable as it is known that a considerable number of the afflicted go home to Cornwall to die.

The Commission's Report emphasizes the fact that miners' phthisis is induced almost entirely by the inhalation of dust created by rock drilling and shovelling, and, incidentally, by air vitiation after blasting. The terrible condition of affairs is illustrated by the statement that the average term of rock drillers' employment is seven to nine years; that is, a driller's usefulness is gone after he has worked from seven to nine years.

As a preventive, the Commission strongly urges the compulsory use of sufficient quantities of water. It is pointed out, however, that the men, and not the managements, are to blame. The miners are incredibly indifferent to the danger of phthisis. As a necessary measure it is recommended that no tuberculars be permitted to work underground.

ONE VIEW OF MODERN EDUCATION.

A passage in the inaugural speech of Dr. James Moir, president of the Chemical, Metallurgical and Mining Society of South Africa, is so apt that we quote it here in full. Dr. Moir hits hard and straight:

"What is wanted of modern education is that it shall produce a man who is both a gentleman and an accurate problem-solver; as an American writer says, 'it is necessary to understand that moderately accurate knowledge is like a moderately fresh egg;' and I may say at once that accurate knowledge is not to be gained from text-books and a 50 per cent. pass examination, but solely from the experimental method. Unfortunately, as Armstrong says, our headquarters are 'people who have never knowingly made an experiment, and do not even know how to set about making one.' The result is seen in the so-called 'educated population,' three-quarters of whom still believe in water-diving, or in finding live frogs in stones or similar superstitions, all on evidence, too, that wouldn't convict a nigger. Even the universities want reforming badly: they should leave text-book examinations to preparatory schools, and they should give proper scientific degrees. Why, for example, should the Cape University call a man a Bachelor of Arts after he has passed an Honours examination in Science? What they should organize is a degree in Technics, or Applied Science, only to be given after training in experiment and research. I assume, of course, that elementary science will have been taught at school. The fact is, that British university training, is, almost everywhere except in Scotland, modelled on the Oxford and Cambridge type: the former of these universities apparently considers the acme of human culture to consist in the knack of rendering into more or less indifferent Greek such things as 'we don't want to fight, but by Jingo if we do,' whilst the strong point of the other university appears to be the cultivation of a certain carefully artificialized variety of English speech; and, in both universities, sad to say, Chemistry, almost the most fundamental branch of human knowledge, is relegated to a back seat under the name of 'Stinks.' I will myself say nothing of the educative and disciplinary value of chemistry; let Nernst speak: 'the doctrine of the constitution of organic compounds stands at the head of all theories that the human mind has ever conceived.' "

THE INTERNATIONAL GEOLOGICAL CONGRESS.

From the gathering together of professional men there comes good. The Canadian Mining Institute transcontinental excursion, in 1908, brought definite and prompt commercial results. Also it established many lasting friendships. It is not to be doubted that the recently concluded International Geological Congress will induce similarly beneficent effects.

Dr. W. G. Miller, who was Ontario's representative at the Congress, contributes to our pages a very interesting account of the convention in Sweden. In commenting upon certain iron mining enterprises, Dr. Miller alludes to the surprisingly good treatment accorded to the Swedish miners. The mining towns are commendably clean. The men are well cared for and are well paid. Living expenses are low. Pensions for long service, and insurance against injury are provided. Herein is food for thought.

Canadian operators, especially operators of iron mines, will do well to read carefully and to digest thoroughly this highly informing article.

EDITORIAL NOTES.

The State Geologist of Wyoming, Mr. Edwin Hall, recognizing the evil wrought by long-distance promoters, wrote lately a strong letter on the subject of oil promotions in Wyoming. At the request of Sir Boverton Redwood, to whom the letter was addressed, the communication was published in full in "The Financial Times," London, Eng. Mr. Hall has a practical sense of his duty to the public and to his own state.

Judge Mabee, as chairman of the Dominion Railway Commission, has given recently a decision that bears upon the mining development of northern British Columbia. It appears that, contrary to specific agreement, the White Pass & Yukon Railway has fixed an exorbitant freight rate as between Carcross and Skagway. This rate the Commission decided to cut in half.

A fourth edition of the geological map of the Cobalt area has recently been published by the Ontario Bureau of Mines. The first edition was issued in 1904 before Cobalt had attracted the attention of the public, and was of service to the early prospector in the camp. There have also been reprints of the first three editions. Separate maps have been published from time to time of South Lorrain and other areas contiguous to Cobalt. The last edition combines therewith the area mapped in 1904 and includes the Gillies Limit. The new map is in the same scale as the former ones, 1 mile to 1 inch. The large scale map, 400 feet to 1 inch, was published in 1907.

Great Britain imports granite in large quantities from Belgium, and marble from Italy. The great bulk of imported granite, however, comes from the Channel Islands.

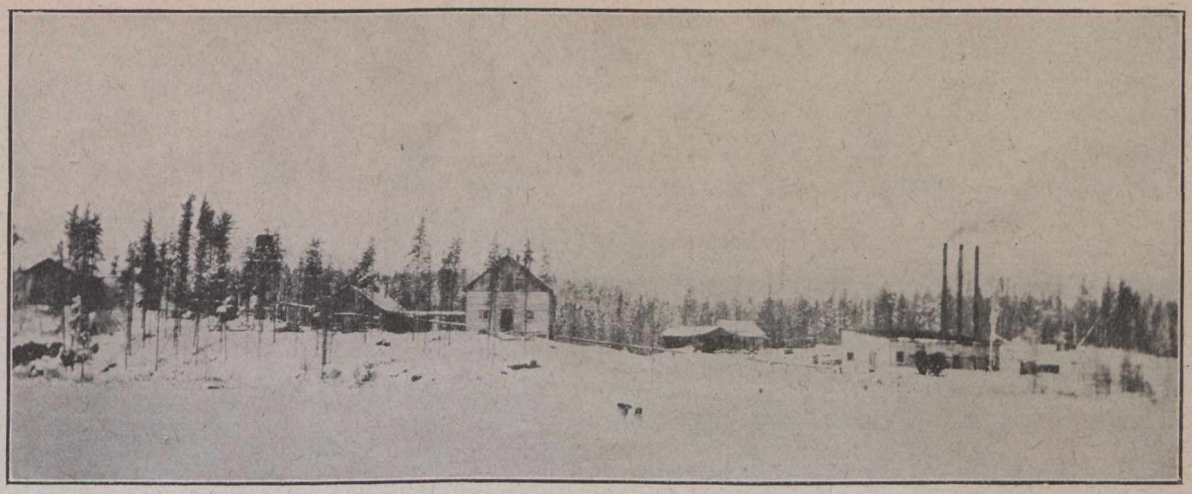
PRESENT DEVELOPMENTS AT GOWGANDA

(Written for the Canadian Mining Journal by G. M. Colvocoresses.)

People visiting Gowganda this summer complain that the camp is very quiet and, from some points of view, this is certainly a fact. From the standpoint of the boomer Gowganda is now numbered among the down-and-outs, and in the columns of certain daily papers it no longer furnishes the settings for thrilling romances of the Monte Cristo order. On the other hand, there is more real serious development and mining work going on than at any time in its short history, and in many cases the results are highly encouraging.

A glance over the present situation shows both bad and good points; the latter I think predominate. The failures that have already been recorded can nearly always be traced to one of two causes,—trying to mine where there is no silver, or lack of sufficient capital to develop properly the property. The last mistake can often be rectified in time; the first is bound to be fatal. There is no excuse for people who buy claims that they have never seen nor have sent any responsible person to examine; no more is there for those who purchase a property on which has been found diabase, calcite and the so-called "aplite," with the conviction that large bodies of pay ore must necessarily be associated with these rocks; and there seems but little more excuse for the men who paid $100,000 in cash, on the surface showing of a single tiny vein with a high grade silver ore shoot two feet in length, three-quarters of an inch wide, and developed by test pit eight feet deep. As a matter of history the ore shoot referred to and many others like it have never produced $100 worth of silver.

At the present time several Gowganda properties are closed down or operating with reduced forces of men. Some of these properties have not been able to find any ore, but in other cases promising finds were made and the suspension of work is due to financial difficulties or lack of power plants, which cannot be installed until next winter. In these cases the management figures that it will be more advantageous to wait until winter than to continue work by hand throughout the expensive summer months. I say expensive summer months because Gowganda is a topsy-turvy place in this respect. It is fifty miles from the railroad and in the midst of a forest, where nothing edible is yet grown and no industries or settlements are established. In winter, over the snow road and lakes, it costs $1.50 per 100 pounds to bring in supplies from the railroad; in summer by boat to Elk Lake, and thence by a very rough wagon road, it costs $2.50 to $3.00 per 100 pounds, with a practical impossibility of hauling in boilers or heavy machinery. So instead of laying by supplies for the winter, Gowganda takes advantage of the winters to bring in its machinery, send out most of its ore and lay in supplies to last until the succeeding December. Some day, it is to be hoped that a railroad will find justification for building



Camp and Power Plant, Millerett Mine

into the camp, but that has not yet been the case. After all, Gowganda is barely two years old, and development under the existing conditions is of necessity slow.

On the bright side of the picture it may be said that Gowganda has already (September 1st) shipped out 415 tons of cobalt-silver ore, contributed by seven different mines, and another 100 tons is now bagged up in the ore houses. About 120 tons of the production is high grade ore assaying between 3,000 and 4,000 ounces in silver per ton, and the balance is second grade ore assaying somewhat less than 800 ounces per ton. Besides this there are several thousand tons of low grade ore on the dumps awaiting the arrival of concentrators, of which I shall have more to say later.

Another encouraging point is the continually widening area in which good properties are being developed. Last summer nearly all underground work was confined to the Gowganda ridge and the Miller Lake section, whereas this year development is going on to the south and west at Smoothwater, Wapoose, Spawning, Duncan, and Shining Tree Lakes, and to the east at Calcite, Bloom, Lost, Wigwam, and Long Point Lakes. At all these places some ore has been bagged up and it looks as if productive mines might be developing.

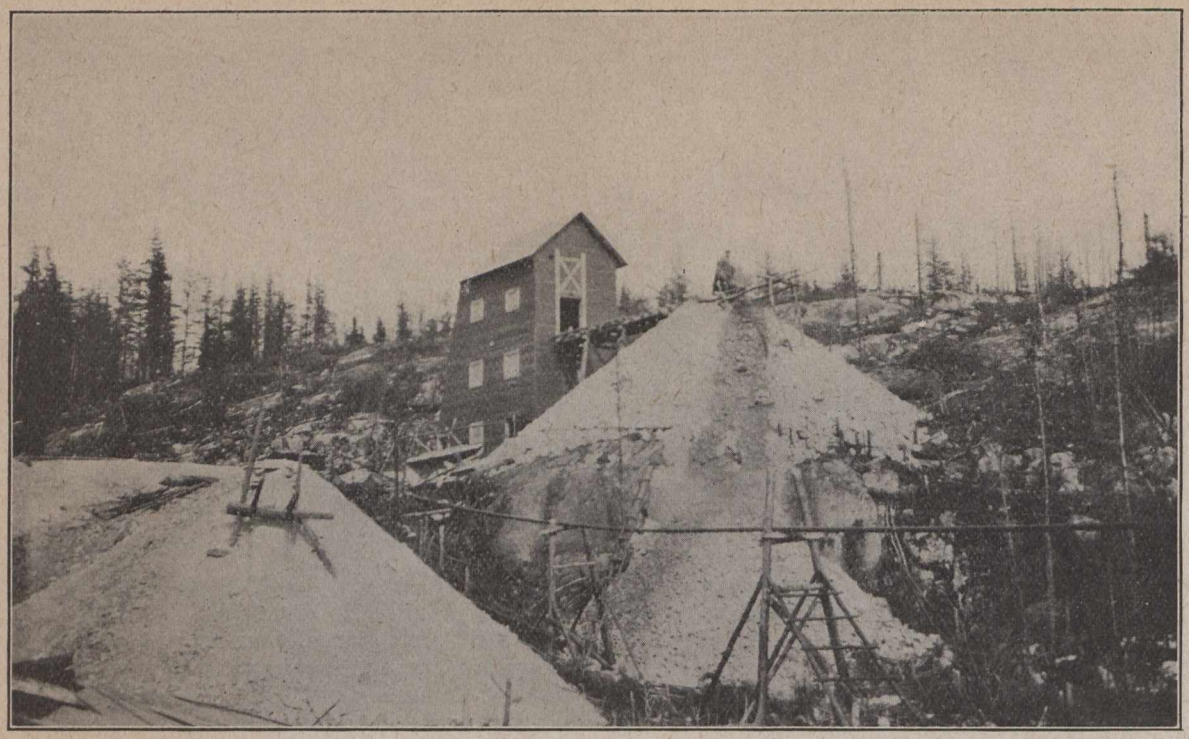
The geology of the Gowganda district is similar to that of Cobalt and the Montreal River section, and I shall not describe it in detail. The rock formations are Keewatin greenstones, Laurentian granite and gneiss; Huronian conglomerate, slates, graywackes, quartzite, and Pre-Cambrian diabase. With one notable exception all the producing veins have so far been found in the diabase.

The original discoveries of the camp were nearly all made on bald bluffs and ridges, but this seems merely due to the fact that these ridges required no stripping and were most easily prospected. Subsequent work has uncovered equally good veins under overburden and in the hollows and when the underground exploration gets under the muskegs and shallow lakes which occupy a very large area there is good reason to believe that, as at Cobalt, important finds will be made beneath them.

A more detailed description of some of the mines in the camp may be of interest, the properties mentioned being those on which the development work has been most extensive and with which the writer is best acquainted. There are many other properties which from present indications will have equal merit.

Near the south end of the "Ridge," just west of Gowganda Lake, is located the Bartlett mine, which for certain reasons was once the most widely known proper-

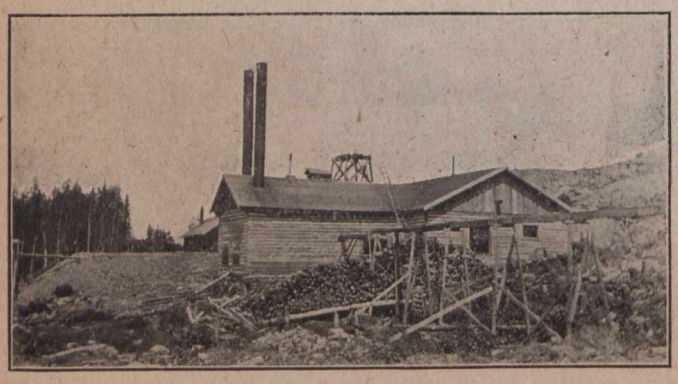
Car Load of Ore Leaving Mine for Charlton



No. 1 Shaft, Millerett Mine, April, 1910

ty in the camp. The prospect itself appears to have real merit. The surface showings were very fine and two shafts some distance apart have been put down to a depth of 100 feet. Very little drifting or crosscutting was done at this level. The ore shoots appeared to pitch in the veins and no ore was found in the bottoms, though it had shown up strong for 40 or 50 feet in depth. Some high grade ore over three inches in width was taken out in sinking these shafts; one ton was shipped out last summer by canoe and a few tons are left in the ore house. The mine is equipped with the largest plant in the camp, much too elaborate for a prospect. This consists of two 85 h.p. return tubular boilers, a 12-drill compressor, high speed engine and generator for electric lights, large hoists, pumps, machine shop, etc. The cost of the plant and its erection is said to have been $125,000, and after this expenditure there was comparatively little money left for development work, and in December, 1909, the mine closed down. Since then the company owning this property has been partially reorganized, and it is to be hoped that operations will shortly be resumed and the mine be given a chance to show its value as an ore producer and not as a vehicle for stock jobbing.

North of the Bartlett is located the Reeves-Dobie,



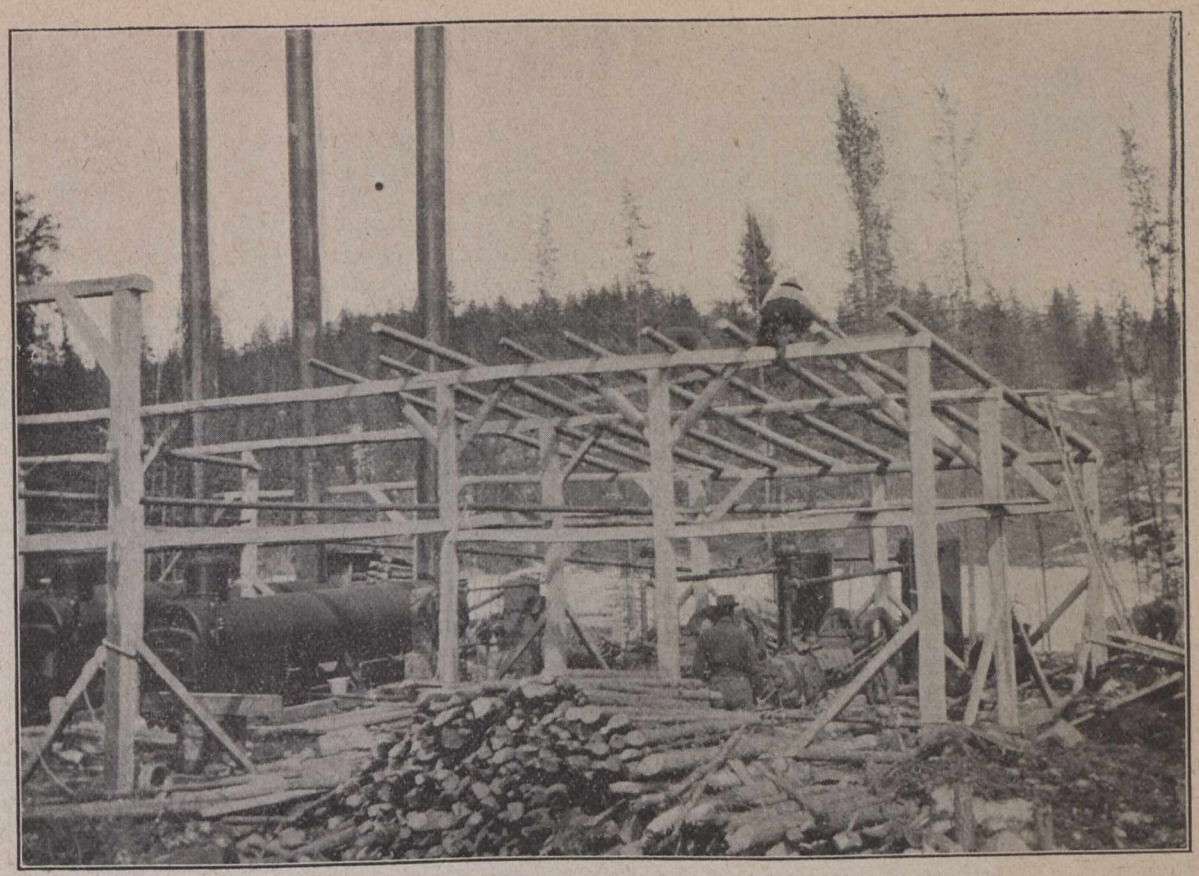
Power Plant Reeves-Dobie Mine

which had the finest surface showings in the camp. Last winter 62 tons of ore were shipped, extracted largely from open cuts near the surface, and several tons are now bagged up awaiting shipment next winter. Besides the original showings, many new surface finds have been made and the stripping has proved a dozen veins in a width of 300 feet lying parallel to each other and nearly all showing high grade ore shoots. The main shaft is now down 200 feet, and a crosscut has been started to intercept these veins, and should they prove strong at this depth the future of the property will be assured for some time to come. At another point several calcite veins close together and all carrying a little silver give a body of ore 12 feet wide and said to average close to 100 ounces in silver. This has been developed to a depth of 80 feet and the management are so well satisfied with the quantity and grade of ore shown that they have ordered a small mill consisting of a crusher, four Nissen stamps and Wilfley tables, and this equipment is now on its way to the mine.

The Reeves-Dobie veins extend over into the Welsh claims, where active development is in progress. Two shafts are now down about 50 feet on different veins and both show some silver in the bottom. Moreover, an adit crosscut is being driven from the hillside to cut through all the principal veins at a depth of 120 to 160 feet. This has now a length of some 250 feet; but when completed will be over 1,200 feet long and will join with both the shafts.

A mile north of these properties the Mann mine is working. The spectacular hillside silver shoot which used to be one of the sights of Gowganda is no longer to be seen. At this particular point the production was most disappointing, for the rich ore only extended down a few feet below the outcrop. However, several other good finds have been made on this property, and from one of the veins good ore is now being taken at the 90-foot level, while upwards of $20,000 worth of high grade material is in the ore house and several hundred tons of mill rock are on the dumps.

Just west of the Mann the Boyd-Gordon has done ex-



Erecting Power Plant, April, 1909

tensive development work with a shaft 125 feet deep and some 500 feet of crosscutting and drifting. This property shipped 35 tons of ore last winter. Work was suspended for a time this spring and summer, but the mine is now operating again and should contribute to next winter's ore shipments.

East of the Mann the LaBrick Company began active developments this summer and are sinking a shaft on a strong calcite vein carrying smaltite and niccolite.

Further north again, several properties are carrying on developments, notably the Bishop and Trans-continental. The surface showings were fairly good, but the underground work has not progressed far enough to prove or disprove the existence of workable ore bodies.

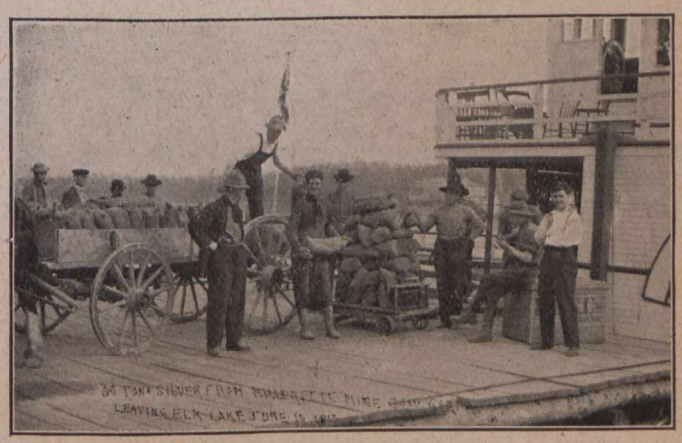
All the producing veins in the Gowganda ridge are of practically the same type. They are narrow fissures in the diabase with little or no evidence of faulting. The width varies from one to three inches and on the surface the veins are traced from 50 to 500 feet, showing calcite throughout their entire length. Cobalt bloom is often found for a good part of the distance, and the silver ore shoots are comparatively short, from 10 to 50 feet in length, though sometimes more than one ore shoot will occur on the same vein. The silver occurs native with calcite and occasionally as argentite or ruby silver, nearly always accompanied by cobalt and nickel minerals, but conversely silver does not by any means always accompany cobalt and nickel, though it can fairly be said that the cobalt is a good indicator for its occurrence. Other minerals found in the veins are bismuth, galena, graphite, specular iron and copper pyrites. These have no commercial value, nor can the presence of any of them be called especially favourable to the discovery of silver.

There are also several strong fault fissure veins on the ridge filled with calcite and from one to six feet in width. Cobalt minerals are found in places in these veins and low silver assays are reported, but in this section no mining has yet been done on them.

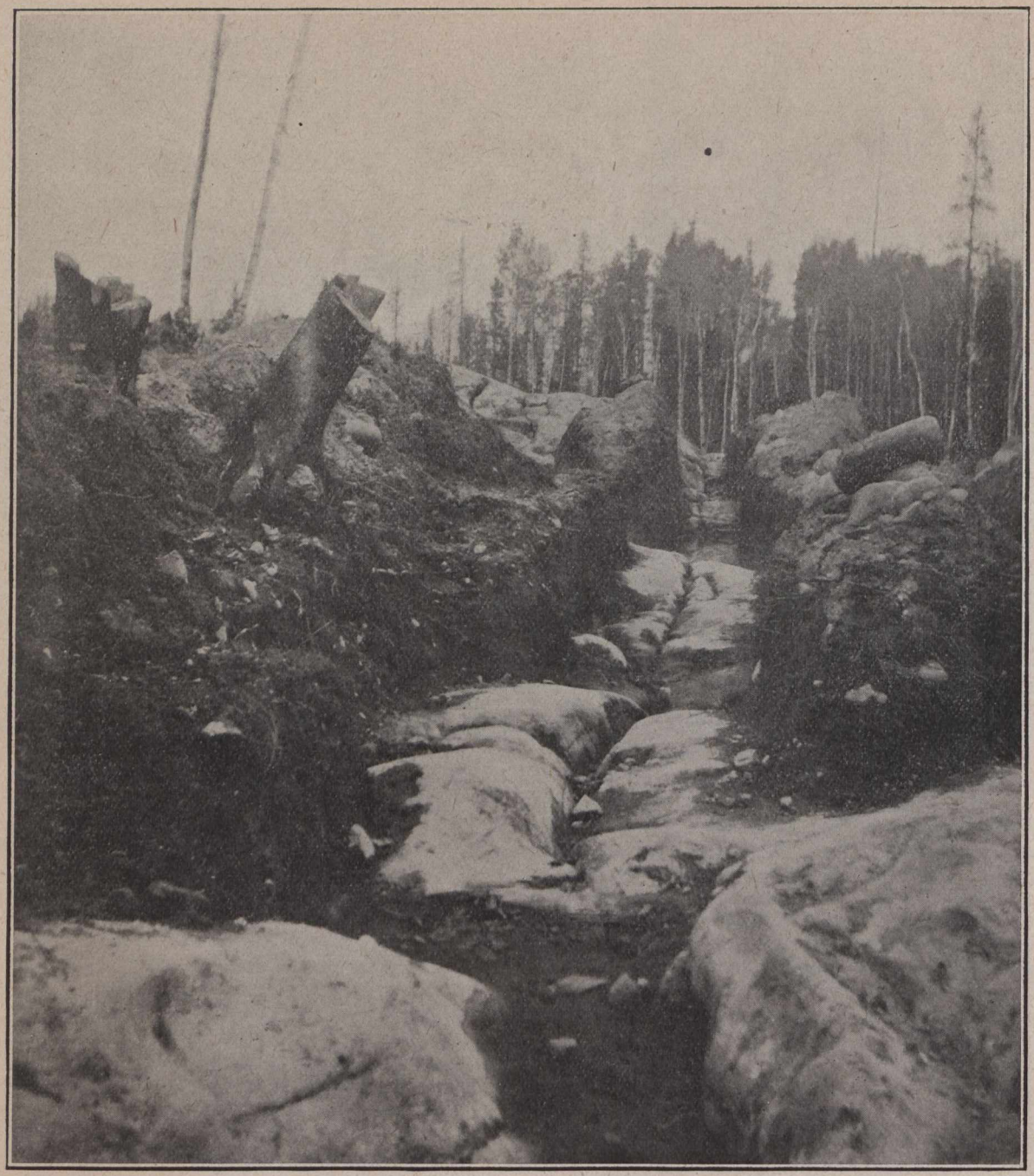
Four miles east of the Gowganda Lake mines lies the Miller Lake group of properties. The veins in this section present more variety than those in the "Ridge," and the development work is just now being carried on more vigorously than in any other part of the camp.

South of Miller Lake, properties have been developed by two syndicates at LeRoy Lake (one closed down temporarily), and by the Canadian-Gowganda and Northern Mining Company (Morrison Claim).

The developments at the two last named have been encouraging. The Canadian-Gowganda is down 100 feet and several veins have been crosscut on both the 58 and 100-foot levels. From the 58-foot level a little ore was produced by the development work and, if work is carried on steadily, the mine should ship next winter.



Loading Ore Shipment on Montreal River Steamer at Elk Lake



Mann Mine Trenching, Showing Surface of Typical Vein

On the Morrison property developments only started in July and two shafts are being sunk on a strong calcite vein having a width of three to eight feet and traced on the surface for one-third of a mile. There is silver in both these shafts, the high grade ore being confined to a width of four inches. Elsewhere the calcite contains copper and iron pyrites, galena, bismuth, smaltite and niccolite. Two other veins which intersect the main lead show silver on the surface, and the outlook of this prospect would seem exceptionally promising.

Just north of Miller Lake is the Gates, or Big Six mine, belonging to Mr. M. J. O'Brien. This property has been vigorously developed ever since March, 1909, and last winter eleven tons of ore were shipped. The values were pockety in the vein above the 50-foot level; but a marked improvement took place at that depth, and on the 90-foot level the ore shoot is 116 feet long, averages rather better than two inches wide, and the ore assays close to 4,000 ounces in silver. A car load of very high-grade ore has been extracted this summer and will probably be shipped at once.* The ore has every appearance of going down strong, and if another level proves it up equally good, this mine will be a steady shipper. At the present time I think it has the best underground showing in diabase in the camp.

North of the Gates is the Millerett which has shipped 305 tons of high-grade and medium-grade ore. This property, formerly known as the Blackburn claim, has 42 1-2 acres, on which Keewatin, conglomerate and diabase are found. There are some nice surface showings in the diabase and they are being developed at the present time, but so far almost all the production has come from one strong vein in the conglomerate. The high-grade ore

* Editor's Note.—This car has already been shipped and smelted. The returns were exceedingly satisfactory.

showed on the surface for a length of only 20 feet, but an adit level run in from the hillside under a back of 50 feet proved the ore to have a length of 150 feet, and this shoot has now been developed continuously to a depth of 180 feet below the surface and excellent ore is being taken from the lowest level. The width of the vein varies from one to four inches and the high grade ore so far has assayed 3,500 ounces. On each side of the vein for two feet the wall rock is well shot with silver and a large tonnage of good milling rock is on the dump and developed in the mine. To treat this it will probably seem advisable to erect a concentrator this winter.

It should be said that there is a great deal of similar Huronian conglomerate in the Gowganda district, and it appears to warrant more careful prospecting than has yet been accorded to it, for it would be very strange if this formation, which is responsible for 80 per cent. of the producing veins at Cobalt, should carry only this one Millerett vein at Gowganda.

The Bonsall mines adjoin the Millerett on the north and west and development is also in progress on this property. Four tons of high-grade ore was shipped by this company during the summer and ore is being mined at the bottom of a shaft now 66 feet deep.

Northeast of the Bonsall a strike has recently been made on the property of the Everett Lake Company and good ore is being sacked up from a surface opencut 70 feet long.

Something over a year ago the CANADIAN MINING JOURNAL expressed the opinion that Gowganda was a camp well worth prospecting and development. I think this has proved to be the case. The prospecting is still going on and new veins found this summer are quite as promising as any of the original discoveries. The development is progressing and some of it is serving to block out reserves of rich ore, while a small but steady ore production is being made by at least ten different mines, all of which should make shipments this coming winter. The development has proved that it takes both time and money to put a mine on a producing basis at Gowganda and the money has to be put into the ground and not spent in advertising or head office expenses. It has proved that the ore lies in shoots or lenses of irregular length and depth, and in width rarely exceeding two or three inches. These shoots sometimes pinch out into blank calcite, but just as suddenly another good shoot will appear below or further along the same level. The shoots generally pitch in the veins, sometimes at quite a flat angle, and it is this which has caused many shafts to pass through the good ore at a depth of from 20 to 60 feet and often the ore will be picked up in the drifts.

At first Gowganda was looked at solely from the standpoint of a high-grade camp. This is a mistake. A very considerable quantity of milling ore, assaying from 30 to 100 ounces per ton in silver, is now being developed. It is all very nice to mine ore worth $1,000 or more per ton, but the occurrences of such ore are irregular, the veins extremely narrow, the quantity is sure to be limited, and the working costs very high, for, obviously, we must handle four feet width of waste rock to get the one or two inches of bonanza vein matter. It has become a pretty well established rule in all mining camps that in the long run the low grade mines are the biggest dividend payers, and I believe that the greater part of Gowganda production will eventually come from mills treating the comparatively low-grade rock which is really first-class concentrating ore.

So far it cannot be said that any very large mines have been developed at Gowganda, nor, indeed, has the development proceeded far enough to make any definite forecast as to the future of the camp; but from present appearances there are pay veins in the district. There are properties that can make a steady and profitable production and that in another year will deserve to be classed as good little mines, and Gowganda may hope to hold its present place after Cobalt, but a long way after Cobalt, as the second silver producer of Ontario.

THE NICKEL INDUSTRY.

(From Engineering Supplement, London Times.)

The world's production of nickel, which showed a marked increase during the years subsequent to 1900, has for the last few years remained fairly constant. The demand has been steady, but there seems very little doubt that it would have been much greater had the metal been obtainable at a slightly lower price. The price has been high chiefly through the instrumentality of the International Nickel Company, which has controlled prices in America and has succeeded in influencing outside markets as well.

The properties of nickel in itself are such that it will always command a wide sphere of utility. Its resistance to the attack of alkalis, the difficulty with which it is corroded by most acids, its durability, and the high polish it is capable of taking place it high amongst the commoner metals. It is these properties which have led to its adoption for such purposes as field and ship cooking utensils and for replacing copper as coinage, while it has long been used for electro-plating, and in this respect is little inferior to silver, while obtainable at a much smaller cost.

Nickel will alloy with most of the useful metals. Among such alloys the so-called German silver, which consists essentially of nickel, copper and zinc, is most widely known. The most valuable properties of German silver are its white colour, its brilliant lustre, hardness, tenacity, toughness, malleability, ductility, and power of resistance to many chemical influences. The presence of cobalt does not seem to interfere with these properties. A new alloy known as monel metal, which consists of one part copper and three parts nickel, with a small amount of incidental impurities, has many excellent properties, chief of which is its great resistance to the attack of acids.

It is the combination known as nickel steel, however, which utilizes most of the nickel mined at the present day. Nickel steel is principally used for armour plates, but the toughness of this alloy or mixture renders it also applicable for other purposes. Recent tests have shown its utility for rails and for rivets, and it has been adopted for the barrels of small arms. The presenec of nickel, up to 20 per cent., in steel increases the elastic limit and breaking stress, and steels rich in nickel are practically non-corrodible. Alloys have been made containing a high percentage of nickel, but it has been found that for general purposes, taking into account the relatively high price of the metal (at present about £160 a ton), the best result is obtained with the greatest economy when it is present to the extent of about 2 per cent.

Until quite recently the entire nickel supply of the world was obtained either from the Sudbury district of Ontario, Canada, or from the ores of New Caledonia. The other sources are still insignificant compared to these, but there is a possibility of great developments in the near future. About 60 per cent. of the world's nickel supply is mined at the present time in the Sudbury district. As early as 1770 Canada's deposits in Algoma, which borders on Sudbury, were worked as a

source of copper; but the true nature of the deposits was not recognized till in recent times the officers of the Canadian Geological Survey pointed out that they would probably be workable. The Sudbury deposits first attracted notice in 1883, during the construction of the Canadian Pacific Railway, and in 1886 they were first exploited for nickel. The ore in this district is mined and treated by two companies—the Canadian Copper Company and the Mond Nickel Company. A new company, the Diamond Nickel Copper Company, has started operations in the Northern range. The ore of the Canadian Copper Company is chiefly raised from the Creighton mine, which is rich in nickel, while the Mond Nickel Company obtains its supply principally from the Victoria mines. The ore is smelted into a matte by the Bessemer process, and this matte, which contains about 40 per cent. of nickel and about the same amount of copper, is then shipped for the production of pure nickel, by the former to Constable Hook, Nova Scotia and other places, and by the latter to South Wales. The ores from the Cobalt district, worked for their high silver content, give the only other supply from Canada, but in this case the metal is only a by-product, and the nickel content is not reckoned with in the sales. There are indications of workable deposits further north in Canada. Returns for the nickel industry of Ontario in 1908 give the following figures: Ore raised, 409,551 short tons; ore smelted, 360,180 tons; Bessemer matte produced, 21,197 tons; nickel contents, 9,572 tons; copper contents, 7,503 tons. The ore also contains considerable amounts of silver, palladium, platinum and gold.

All the ore in New Caledonia is exported to France, Great Britain and Germany for smelting, although plans have often been discussed for treating the ore on the island. In Great Britain the ore is treated by the Glasgow Nickel Company at Kirkintilloch. The approximate output of nickel ores from New Caledonia during the year 1909 was 120,000 tons.

There are now two other countries which produce nickel. In Norway it is worked in the valley of Sotersdalen, not far from Christiansund. The output in 1908 was only 81 tons, but has now probably much increased. Nickel was produced in the United States for the first time from its own ores in 1908, by the North American Lead Company, but the production was small. The Orford Copper Company and the Balbach Refining Company refine nickel, but obtain their supplies from the Bessemerized matte from Sudbury or from other sources. A deposit of ore somewhat resembling the Sudbury ore has been found in Nevada, but has not been worked. Particulars of a recent development at Webster, Jackson County, North Carolina, were given lately. Dr. Hennig has worked out a process for direct reduction in the electric furnace of a nickel silicate ore found there. A product consisting of silicides of nickel and iron with some chromium, aluminium, magnesium and a little carbon is obtained, which can be applied directly to the manufacture of nickel steel. The production of ferro-nickel, nickel alloys, and metallic nickel is also contemplated.

For refining nickel, or obtaining the metal from a nickel-copper matte, various processes have been adopted. The preparation of nickel oxide and direct chemical reduction gives an impure product as a rule. Formerly commercial nickel only contained about 94 per cent. of the metal, but in the last few years the commercial metal has greatly risen in purity. An analysis of one of the best makes of nickel would give figures of the following order: Nickel, 99.1 per cent.; cobalt, 0.4 per cent.; iron, 0.3 per cent.; carbon, 0.05 per cent.; manganese, 0.05 per cent.; silicon, 0.10 per cent. These figures, and the nature of the elements present as impurities, of course vary according to the nature of the ore and the methods adopted in refining it. In the United States, since 1894, electrolytic methods have been largely employed. Copper is deposited apart from the nickel in the actual electrolysis. Nickel is almost invariably deposited from solutions which have been made alkaline by the addition of ammonia, copper having been eliminated in a previous operation. In Germany, at the Papenburg works of the Aligemeine Electro-Metallurgische Gesellschaft, an electrolytic process known as the Hoepfner process has been adopted. In America the chief processes which have been tried or adopted are the Thum process at the Balbach Company's works, Newark, the process of the Orford Copper Company at Bayonne, New Jersey; the Brown process at Cleveland, Ohio, by the Canadian Copper Company, and the Hybinette process at Sault Ste. Marie.

The process adopted by the Mond Nickel Company at their Clydach works in South Wales is unique not only in the manufacture of nickel, but in the whole domain of metallurgy. The method adopted gives nickel of a very high degree of purity, seldom less than 99.9 per cent., the small trace of foreign elements left being carbon and iron. The Mond process depends on the formation of an easily volatile compound formed by the action of carbon monoxide gas on finely-divided nickel. This compound, known as nickel carbonyl, is easily decomposed by heat, leaving pure nickel, with the evolution of carbon monoxide, which is used again to act on further impure metal. The discovery of the formation of this compound, which was originally accidental, led to a patent being taken out in 1890 by the late Dr. Ludwig Mond for refining nickel, but it was not until 10 years later that it was used on the commercial scale. Since no other element present under ordinary conditions, with the exception of iron to a very limited extent, forms a carbonyl, the nickel is free from other metals, and especially from cobalt, which is separated only with extreme difficulty in other methods of refining. The metal appears on the market in the form of pellets varying in size up to 5-16-inch in diameter. The works at present turn out about 1,800 tons of nickel a year, but are being much enlarged.

The future production of nickel, at any rate in so far as it will be used for the manufacture of nickel steel, will, it seems, lie in the formation of ferro-nickel by direct reduction in the electric furnace, and with cheap electric power, and by working possibly some of the sources of nickel not yet tapped, it seems probable that the price may be considerably reduced. But in such a complicated problem as is afforded by the addition of various alloys to steel, it is difficult to see what the future may have in store. There are indications that vanadium and chromium, if the former can be obtained sufficiently cheaply, may replace the use of nickel; but, whether or not it is superseded as a toughening addition to steel, the fact remains that pure nickel, by reason of its excellent properties as a metal, must always find its uses, and the extent to which it is employed will depend on its cost.

Out of a group of 23 British iron and steel companies whose reports are lately to hand, 17 paid dividends during the past fiscal year, and 6 paid none. Dividends ranged from 1 1-4 per cent. to as high as 30 per cent. Six of the companies paid 10 per cent. or more. 16 companies showed larger cash reserves.

ELEVENTH INTERNATIONAL GEOLOGICAL CONGRESS, SWEDEN, 1910

BY DR. W. G. MILLER.

(Written for the CANADIAN MINING JOURNAL.)

The International Geological Congress meets at intervals of three or four years. In 1906 the congress was held in Mexico and in 1903 in Austria. Meetings in earlier years were held in Russia, France, and other countries. The eleventh, or 1910, congress met in Sweden. At this congress, following the custom of preceding ones, there were geological excursions both before and after the sessions, together with short ones from Stockholm during the sessions.

Parliament Buildings Stockholm, Headquarters of Congress

Before the sessions, which were held during the period August 17th to 25th, one had the choice of eight excursions, the two longest of which began in July and lasted for about three weeks. The excursions were numbered A1 to A8 respectively, and were arranged with the object of illustrating special branches of geology as exemplified in Sweden. For instance, excursion A.1 was to Spitzbergen. In order to show the object of this excursion one cannot do better than quote from the excellent guide book written for the excursionists by De Geer, the distinguished leader of the party: "When it was determined that the International Geological Congress should meet in Sweden, it was but natural to arrange a geological excursion to Spitzbergen, a land, which, owing to the numerous Swedish expeditions, has been called a Swedish scientific conquest. On Spitzbergen the different geological systems are more fully represented than in any other land in the polar region.

"This together with its geographical position gives to Spitzbergen a special geological interest, that land being situated just where the great continents of the eastern and western hemispheres most closely approach one another, thus giving a chance for more reliable time-correlations than is possible by palaeontological evidence alone when applied to far distant localities on different sides of the great oceans.

"Furthermore, Spitzbergen forms a part of the same continental plateau as Fennoscandia, and affords valuable information about the evolution of Scandinavia and the adjoining oceanic depression even during periods which are not represented on the peninsula in question.

"Last, but not least, Spitzbergen affords excellent opportunities for comparative studies of glacial conditions and glacial organisms, the knowledge of which is so necessary for the closer study of such a land as Sweden, being essentially characterized by its former glaciation. It has, indeed, become almost indispensable for Swedish scientists now and then to revisit the Arctic region where it is best accessible, or in Spitzbergen, in order to get the right explanation of such new questions as always arise with the development of science."

Spitzbergen is "no man's land," being under the jurisdiction of no country. Several nations are casting covetous glances towards it, now that a United States company has put the coal deposits on a commercial basis. This coal, by the way, came in very opportunely for the excursion steamer this summer. She ran aground and her supply of coal had to be thrown overboard. After being floated a supply of Spitzbergen coal was secured and proved to be of good quality. Had it not been for the enterprise of the American miners, distinguished geologists of several nations might still be lingering in the chilly atmosphere of the far north. This coaling station, it may be added, disturbs the naval plans of several nations. A supply of fuel for warships is now available from a new quarter.

I shall not, however, say more of the perils and pleasures of the Spitzbergen excursion, although I heard much of them from members of the party on their return to Stockholm, but suggest to the Editor of the Journal that he try to induce Prof. A. P. Coleman, of the University of Toronto, who accompanied the excursion, to write a paper and illustrate it with some of those excellent sketches he made of icebergs, fiords and mountains during the trip.

Excursion to Norrland and Lappland.

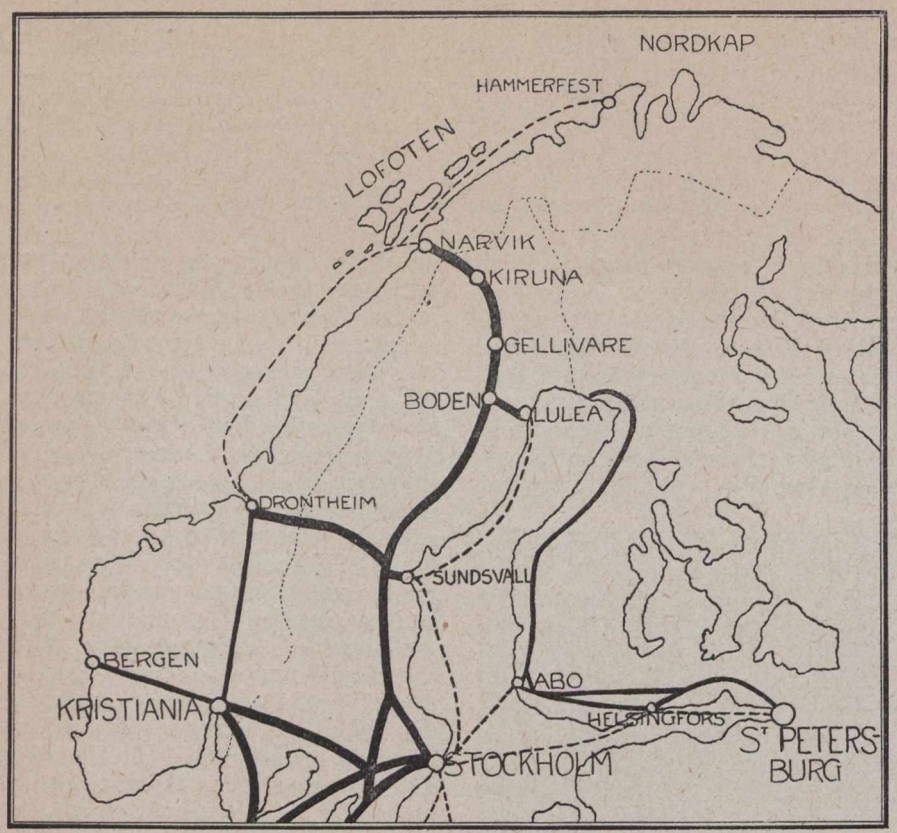
Excursion A.2, which the writer had the good fortune to accompany, left Stockholm on July 27th and returned on August 17th. The object of the excursion was to study "the structural geology and eruptive rocks of Norrland together with the iron ore deposits of Lappland." The route we followed to the north is shown in the accompanying sketch map.

The train was left at Sendsvall and an excursion of a few days' duration was made by boat to Alno and other islands along the coast. After leaving Kiruna we proceeded to the port of Narvils. Thence by boat south along the Norwegian coast to Trondhjem, whence we took train to Stockholm.

We were fortunate in having such an interesting route chosen for the excursion, and we were doubly fortunate in having such good men as leaders. From the day of departure until August 7th, Prof. A. G. Högbom was our "guide, philosopher, and friend." Earnest, enthusiastic, kindly, and conscientious, he captivated us all. The geology of his native country is a serious subject with him. Dilettantism has no place in his make up. What a great theologian he would have made in the olden days!

The first six days of the trip were devoted to a study of thrust planes, pre-Cambrian and other series of rocks, together with an ascension of one of the popular mountains of Sweden, Areskutan.

The next five days were given to "the eruptives of Ragunda, Alno, Rodo and Nordingara," famous locali-



Itinerary Map

ties. We all heard of them in our student days. One gets curious preconceived ideas not only of men but of places. I had always thought of the Isle of Alno as having "a storm- and rock-bound coast"—probably the study of thin sections of alnoite under the microscope had something to do with it—but we found it to be a smiling isle "where every prospect pleases." Our visit was in haying time, and, after looking at outcrops of remarkable rocks, alnoite and various nepheline and olivine-holding types, together with what is said to be eruptive limestone at the seashore, we tramped across country through sweet-smelling meadows and over park-like hillsides, viewing outcrops of various facies of the eruptive rocks, among which was calcite pegmatite. Then we had luncheon beautifully served on a lawn which "scorned Arcadian pride." I, at least, departed from the isle with my preconceived impression of it entirely gone. Alnoite will mean more to me hereafter.

Gellivare and Kiruna.

Having finished the second section of the trip we proceeded northward in order to visit the great iron deposits of Lappland—"les grands gisements de fer de Gellivare et de Kiirunavarra-Luossavarra, leur rapport avec les roches encaissantes." Our leader in the study of these iron deposits was Hjalmar Lundbohm, "directeur des mines de Kiirunavarra et Gellivare." What shall I say of Lundbohm? He possesses social qualities that would make him a desirable member of the Canadian Mining Institute. Need I say more? I wish Sweden were not so far away. We should have him at some of our annual meetings. That Scotch set—the Major, the Colonel, the late ex-Treasurer et al—would find that there are others.

Mr. Lundbohm has accomplished much for the mineral industry. He is given the credit of having done most to make iron mining at Kiruna and Gellivare the great success it has become. Early attempts at iron ore mining in these northern latitudes were not very successful. It was a question of waiting for the man. A former member of the Geological Survey, he saw the great opportunity there was for developing an industry that would be of great benefit to his country. He took hold of the mines when they were almost at a standstill. The government, although subjected to much criticism, built a railway through the barren region of Lappland and to the seacoast, where a harbour has been developed for the shipment of the ores at Narvik. Shares in the company controlling the mines are now selling at about five times their par value. In a short time the mines at Kiruna will be models for the world.

In addition to his work in mining, Lundbohm takes an active interest in all things that tend to the advancement of his country. He is a close student of technical education problems and is providing educational facilities both for the workmen and for the boys and girls of his mining towns. He is also an intelligent student of political conditions in general.

The iron deposits at Kiruna can be classed among the great ore bodies of the world. The following notes on the Kiruna district are taken from Lundbohm's guidebook, prepared for the excursionists:—

Iron Mines at Kiruna.

"About the geology of the country around the gigantic iron ore deposit of Kiirunavaara very little has been known until interest was raised in utilizing the ore technically and commercially, and, in fact, until that time it was rather difficult to arrange systematic investigations in this desolated region. Besides, the proportions of the ore mountain have, so to say, paralyzed the interest of the geologists in everything else, most of them being fascinated by the richness accumulated in the ridge of the mountain. Very few devoted their studies to the remarkably interesting surroundings.

"The first accurate, and, indeed, very important and useful survey of the iron ore deposits and of the district, was executed in 1875 by a commission in charge of the

Geological Survey. Later on K. A. Fredholm collected some very interesting data, which were published. In 1896, Professor Helge Bäckström and the author of this paper started a thorough investigation and published a short description of the more essential geological and petrographical features of the district; in 1897 the author made a study of the deposits from a practical point of view for the government, and lately very important and extensive reports have been published by O. Stutzer and P. Geijer.

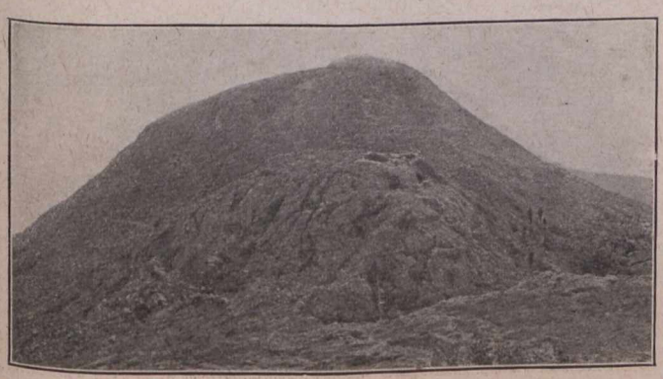
General View of Kiirunavaara Iron Ore Mountain

"The Kiirunavaara and Luossavaara iron ore fields are situated in Lappland, halfway between Torne River and Kalix River, about 90 miles north of the Polar circle, 186 miles from the port of Lulea at the Baltic Sea and 105 miles from Narvik at the Ofoten Fjord in Norway. Both these ports are connected by a railway, built for ore transport, but also connected with the railways of southern Sweden. The distance from Kiruna railway station to Stockholm is 876 miles.

"The preparatory work for the mining of the ore was started in 1898; in the following year, when the railway reached Kiruna, it could be continued on a large scale; in 1902 the railway was completed and prepared for extensive traffic, which commenced in 1903, when about 800,000 tons were exported.

"Kiruna is situated in a desolate country, quite uninhabited before mining was commenced, and only periodically visited by Laps, the nomadic tribes, that for many hundred years have been the only inhabitants of the district and still are numerous and comparatively prosperous.

"The climate is rather severe, the yearly average temperature being 29.3 degrees, and the winter, lasting from the beginning of October to the end of May, generally bringing huge masses of snow and very often a temperature of 4 to 31 degrees below zero. During one month, at Christmas time, the sun is below the horizon, but in the summer the midnight sun gives a bright illumination day and night.



Statsradstoppen Summit of Kiirunavaara Iron Or Mountain

"In the year 1900 the building of houses was started at the new place Kiruna, and since then a community has grown up, now containing about 7,800 inhabitants. From the central part of the town an electric railway is built for the workmen to the foot of Kiirunavaara, from where they are carried on an incline up to the mines.

"The iron ore mountain is on an elevated plateau consisting of vast moorlands and moraines. Several rather big, rounded, mountains and hills rise in the neighbourhood. The Kiirunavaara and Luossavaara are the highest, the former reaching a height of 2,453 feet above sea level and 853 feet above the flat valley between the two mountains. The whole district lies in the birch region and most of the tops rise above the tree limit.

"The ore mountains, forming the central part of the district, consist of igneous rocks, syenites, and porphyries, the ore lying in the latter, and this whole igneous district is bounded on both sides by sedimentary rocks. These are in the west a series of conglomerates, resting on more or less metamorphosed igneous rocks, temporarily called soda-greenstones, all grouped together under the name of the 'Kiirunavaara complex.' The series bounding the ore-bearing porphyry district in the east is called the 'Hauki complex,' after the hill Haukivaara. It consists of quartzites, conglomerates, phyllites, beds of igneous rocks and of a relatively thick formation of quartzitic sandstone. East of these rocks there is another area of ore-bearing porphyry.

The Iron Ore.

"In the area here described there occurs commercially valuable iron ore in Kiirunavaara, in the mountain ridge itself and in some minor deposits to the south-east of the great ore body, in Luossavaara as a comparatively large deposit commencing far down on the southern slope of the mountain, and extending across the top down upon the northern slope, and as a small deposit upon the eastern slope of the mountain, and finally in Tuolluvaara. There are, besides, minor deposits of low grade magnetic iron ore in a small area between the lakes Syvajarvi and Nokutusjarvi, and there appears numerous long but narrow strata of low grade hematite in the rocks of the Hanki complex.

"The Kiirunavaara ore deposit commences in Luossajarvi and continues towards the south, as far as is known, with a length of somewhat more than 5 kilometres (3 miles). The mountain ridge itself, with a length of about 3.5 kilometres (2 miles), consisting exclusively of iron ore, is divided into 11 more or less strongly marked hills. When the survey and mapping of the mountain was executed in 1875 by a commission appointed by the government, these hills were given names after the persons who in some way or other took part in the work.

"Although the iron ore generally is intersected by innumerable joints, it has resisted the erosion very much better than the surrounding rocks, which is the reason why the ore forms an elevated ridge in Kiirunavaara and a well marked top in Luossavaara. In the former mountain the ore dips to the east about 54 degrees. The hanging wall has been eroded more than the foot wall and for this reason we do not get the right width of the ore body by a direct measurement. It has, however, been possible to find the dimensions near the surface with the help of cross sections constructed according to the angles of dip found by diamond drillings.

"In the about 3,000 metres (10,000 feet) long mountain ridge, where the boundaries of the ore body are very well known, its horizontal width is on an average 96 metres (315 feet) and the thickness, at right angles to the hanging and foot walls, 78 metres (256 feet) ac-

cording to measurements made on 56 section-lines, taken 50 metres (164 feet) apart. There is no exception from the rule that the ore body is heavier in and around the highest tops and narrower in the lower parts of the ridge. The maximum thickness has been found in a cross section through the hill Geologen, where the horizontal width is 196 metres (643 feet) and the thickness about 164 metres (536 feet). In the highest peak, Stratsrädet, in a tunnel right across the ore body, 138 metres (453 feet) above the level of the lake, the horizontal width is 188 metres (617 feet). In the lowest parts of the ridge the width of the ore varies between 40 and 56 metres (131 and 184 feet).

"The horizontal area of the ore body, including the deposits south-east of the ridge as well as the deposits in the lake, has, by adding areas of horizontal sections, each of a length of 50 metres (164 feet), taken at the outcropping of the hanging wall, been calculated to be about 436,000 square metres (4,692,104 square feet).

"The question as to the depth which this deposit reaches is of equally great interest from a theoretical as from a practical point of view, but unfortunately we are lacking material for a safe estimate of the same. In order to obtain information as to the quantity and quality of the ore, a great number of diamond borings were made to a total length of nearly 6,000 metres (19,680 feet), and important conclusions may be drawn from the results of these borings.

"Below the level of the Lake Luossajärvi the boundary between the hanging wall and the ore is struck at eight different points of which three lay respectively 146.7, 205, and 236.7 metres under that level. The boundary between the ore and the foot wall has been struck at six points, of which two lay at a depth of 106.8 and 114.3 metres. The greatest known depth of the ore is in the claim Zenobia, where the drill hole finished in ore 300.6 metres below the lake, and thus 548 metres (1,797 feet) under the mountain's highest top. Here the ore must have a considerably greater breadth deep down than in daylight.

"The borings, as well as the mining, have proved that the dip of both the hanging wall and the foot wall is very variable, but, if the averages for all observations are calculated, it becomes practically equal. Thus these borings confirm the supposition first arrived at, that the walls of the ore body are very uneven and consequently that such variations in the thickness as occur in the surface also may occur in the vertical direction. In other words, we must not from the incidental decrease in thickness draw the conclusion that the ore rapidly wedges out. On the contrary there seems to be a very strong reason to believe that the ore body continues to a great depth, an assumption which has been strongly confirmed by the survey of Carlheim Gyllenshold.

Luossavaara Ore Deposit.

"The ore deposit in Luossavaara, which is quite separated from that of Kiirunavaara, has a length of about 1,200 metres (3,936 feet) and reaches its greatest width at about 50 metres (164 feet) in the top of the mountain. The ore dips about 65 to 70 degrees east. Those diamond borings, which have hitherto been carried out, indicate a decrease in thickness of the ore body in depth.

"In the hill Tuolluvaara there are a number of ore deposits scattered round. The largest of them has a horizontal width of up to 30 metres, and dips about 60 degrees southeast. The horizontal area of the outcrop of all the more valuable ore bodies has been estimated to be about 14,800 square metres (159,307 square feet). According to the results of some deep drill holes, the largest should wedge out 230 metres (754 feet) below the surface, but there are strong reasons to believe that it has a pitch to the southwest and probably continues to a greater depth.

Character of the Ore.

"Another more interesting peculiarity is the richness of the ore. The ore, consisting almost exclusively of magnetite, is remarkably free from all non-metallic constituents, except apatite. Hematite occurs intermixed to a larger extent in the hill Professorn and in some parts of Luossavaara; as small, irregular lumps, crystals and very numerous thin crack-fillings in the magnetite, the mineral is found everywhere, but perhaps most commonly in the hills Geologen, Bergmästaren and Kapten in Kiirunavaara; and also in Tuolluvaara.

"Among other minerals, occurring sparingly, may be mentioned pyroxene and uralite, tourmaline, talc, and asbestos. Calcite and pyrite are rather common in cracks at greater depths, especially in the hill Professorn; rutile is found in thin sections of very pure magnetite in the hill Vaktmastaren, and titanite as idiomorphic crystals in the ore, for instance in the southernmost hill Jagmastaren and more commonly in Luossavaara . The amount of titanic acid in the ores is generally not as much as .0.5 per cent., the sulphur percentage averages 0.05 or less.

"Apatite is also present, but in the most varying proportions. In the northernmost hill, Vakmastaren, now mostly quarried out, and also in the most southern hills, Porfessorn and Jagmastaren, there is ore with as little as 0.16 per cent. of apatite in such quantities as to permit mining on a large scale. In the intermediate parts of the mountain the percentage of phosphorus is generally high, sometimes rising to 4 or 5, corresponding to 21.6 to 27 per cent. of apatite. Even the mode of occurrence is very variable. Sometimes the mineral in large quantities is so finely disseminated in the magnetite that it cannot be discovered without the microscope. At other times it is found as smaller grains, as fine veins or filling of cracks, or as irregularly formed masses, in many cases bed-like, up to 0.3 metres in width and 10 to 15 metres in length.

"In some parts of the Kiirunavaara wedge and especially near the foot wall in the hills Statsradet, Geologen, and Kapten, the ore is laminated and consists of very thin layers of apatite alternating with thin sheets of iron ore. This produces a remarkably fine stratified structure, which no doubt is one reason why some geologists have made up their minds that the ore body must be of sedimentary origin.

"In other cases the structure of the apatite masses more resembles that of ordinary mineral dikes.

Reindeer.

"The ore in Kiirunavaara and Luossavaara is always extremely compact and hard and shows microscopically in general no crystalline texture. The Tuolluvaara ore has a fine-grained crystalline structure. In the first-named mountains, but especially in Kiirunavaara, there is a very conspicuous jointing, which has the effect that the ore, when blasted, splits in small, often rhomboid-like pieces."

In order to show the chemical composition of the ore, some representative analyses are given below:

	1	2	3	4	5	6	7
Fe_3O_4	76.01	91.50	65.31	96.10	68.73	89.39	90.05
Fe_2O_3	4.58	0.94	5.83	0.76	26.33	2.85	4.60
MnO	0.93	0.20	0.15	0.13	0.22	0.12	0.12
MgO	0.75	1.45	1.15	0.62	0.54	1.94	1.83
CaO	8.92	2.22	14.04	0.60	0.60	0.81	0.42
Al_2O_3	0.79	0.81	1.26	0.20	1.38	0.48	0.34
TiO_2	0.13	0.21	0.05	0.50	0.30	0.17	0.11
SiO_2	1.80	1.74	1.04	1.02	1.94	3.66	2.14
P_2O_5	6.713	1.28	10.97	0.016	0.122	0.19	0.016
S	0.050	0.018	0.036	0.026	0.014	0.045	0.059
Total	100.673	100.368	99.836	99.972	100.172	99.655	99.685
Fe	58.25	66.92	51.37	70.12	68.20	66.72	68.43
P	2.931	0.561	4.789	0.007	0.053	0.085	0.007

Analyses 1-4 are of Kiirunavaara ore, 5 of Luossavaara, and 6 and 7 of Tuolluvaara.

Origin of the Ores.

"The question of the genesis of these enormous iron ore deposits naturally has attracted the attention of geologists. The theories expressed essentially follow two lines: the pneumatolytic-hydrothermal, proposed by Bäckström, 1898, and supported by De Launay in 1903; and the magmatic, first suggested by Hogbom and defended by Stutzer and lastly by Geijer."

The Gellivare Iron Mountain.

The ore bodies of Gellivare, while smaller than those of Kiruna, are of large size, as will be seen from the following notes taken from Prof. Hogbom's guide book on "The Gellivare Iron Mountain":

"All the economically important iron ores occurring in Lappland are enclosed in syenitic rocks, which occupy a considerable area extending from the vicinity of Lake Torne Trask in the north to Gellivare in the south. Besides the syenitic rocks a number of granite and gabbro massives play an essential part in the composition of this area. Furthermore, dikes of granites, pegmatites and basic rocks are very common, and here and there sedimentary complexes appear as scattered remnants, pressed down in the syenite rocks.

"The iron ore field of Gellivare is located in a zone of syenitic rocks which may be regarded as a southern ramification from the north Lapponian syenitic area. In the south this zone is bounded by a gabbro massive forming the conspicuous Gellivare Dundret. To the northwest a granite area (the Linaalf massive), and to the north a complex of quartzites, amphibolites and mica schists (Nautanen schists) bound this syenitic belt. In the midst of the same the mountain Malmberget ('the Ore Mountain') rises, surrounded on all sides by moraine and swamp covered lowlands, under which the contacts between the syenitic rocks and the adjacent rocks just mentioned are hidden.

"The ore deposits of Gellivare are all situated in this mountain, which therefore rightly has been named the Malmberget.

"The Malmberget rises with its highest point, Walkomman, 616 metres (2,020 feet) above the sea, or about 300 metres (984 feet) above the surrounding lowlands. The summit of Walkomman is covered by birch woods and reaches beyond the pine forest boundary which runs on a level of about 540-550 metres (1,800 feet). Even the eastern part of the mountain, the Kungsryggen, with a maximum height of 580 metres (1,900 feet), reaches a little beyond the same forest boundary. The mountain extends east and west and has a length of 6 kilometres (3.7 miles). Two lower offshoots are directed to the south, the Kaptenshojden branching out from the Kungsryggen and Parvavaara from the Walkomman.

"The main ore belt, with a length of about 4 kilometres (2.5 miles) from Walkomman in the west to Tingvalls Kulle in the east, following in the western part the southern slopes of the mountain, where it is marked by a series of mines and dumps, easily visible when approaching Malmberget with a train from Gellivare. The eastern part of this ore belt runs on the northern side of the Kungsryggen and cannot be seen from the south. The mines situated on the eastern slopes are likewise not visible from this side. A group of mines is situated on the southern slope of the Kaptenshojden and attract the attention when the train approaches the station of Malmberget."

Historical Notes—Production.

"The first accounts of the iron ore of Gellivare date from the beginning of the eighteenth century, and already in the middle of the same century mining and iron production on a small scale had been tried. The ore was transported by reindeer to some small blast furnaces in the neighbourhood. Later on (1799-1810) the eminent scientist and patriot, S. G. Hermelin, who was in many ways a pioneer for the colonization of this remote country, made energetic, but quite fruitless, attempts to start an iron industry on a greater scale. After the Hermelin period the mines changed hands many times and considerable capital was consumed, but, because of the high percentage of phosphorus and also because of lack of communication, the output was insignificant and the work was repeatedly stopped. It was not until the invention of the 'Thomas method' and the building of the Gellivare-Lulea railway (1888) that a new era began for this great Lapponian ore field. Since 1903 the main part of the same has been in the hands of the Trafikaktiebolaget Grangesberg-Oxelosund, which also works the mines of Kiruna and Grangesberg. Since 1907 the Government has been a partner in the association, and, by a contract, in force until 1933 (eventually 1938), the production of ore for export is fixed at 18.75 (or 22.50 to 1938) million tons, distributed over the period 1907-1933 (1938).

"The shipping harbour for the Gellivare ore is Lulea and the export goes chiefly to Westphalia (via Rotterdam) and to Silesia (via Stettin); a minor part goes to England, America and other countries.

"Besides the Grangesberg Company, another company, Bergverksaktiebolaget Feeja (since 1898) works a mine

in the Gellivare ore field, viz.: the Koskull Kulle mine, with an annual production at present of about 200,000 tons, which is exported to Witkowitz (Austria).

"The total annual output of the Gellivare ore field averages at present 1.2 million tons, and the hitherto exported quantity reaches about 16 million tons. For the Swedish iron industry, which is chiefly based on iron ores with low percentage of phosphorus, the Gellivare ores have only been used to a very small extent. A furnace at Karlsvik, near Lulea, produces some ten thousand tons of iron from the Gellivare ore (magnetic separation, briquetting, by the Grondal method).

The Ores.

"The average chemical composition of the iron ore from this ore field appears from the analyses here given. The most striking features are the high percentage of iron, the low amount of intermixed silicates, and the variable, often rather high percentage of phosphorus. The figures are averages of considerable quantities of ore. A much higher percentage of phosphorus is found in more limited parts of an ore body, for instance up to 4 per cent. and more in the Walkomman ore; and, on the other hand, the ore may be here practically free from apatite and silicates and consist of almost pure magnetite.

"Mineralogically, as appears from the analyses, there can be distinguished several varieties of ores, according to the kind and amount of the intermixed minerals. With regard to the iron ores per se two types occur, the magnetite ores and specular hematite ores, of which the former are predominant. Intermediate forms between these types are also found, the ore minerals often being mixed; but, on the whole, the types are tolerably well separated. As to the distribution of the kinds of ore, there is no general rule. Sometimes the hematite ore is located in the hanging, sometimes in the foot wall of the magnetite, or it is enclosed in the same, or it forms independent bodies. The different modes of occurrence are illustrated by the Walkomman, Linne, Baron, Hermeline, Skäne, and Oskar mines. There are circumstances that indicate that the hematite or specular iron is secondarily formed from the magnetite; but whether that is always the case is doubtful. It can be said in favour of a secondary origin that the wall rock of the hematite is often somewhat decomposed, but there are also contacts, which show the same characteristics as the magnetite ore contacts."

Lapplander Church, Gillivare

	1	2	3
Fe_3O_4	94.70	78.84	75.29
FeO	0.32	14.33	13.20
MnO	0.15	0.15	0.13
CaO	0.75	1.71	3.66
MgO	0.79	0.50	0.80
Al_2O_3	0.79	0.44	0.66
SiO_2	2.06	2.51	3.07
TiO_2	0.47	0.16	0.21
P_2O_5	0.03	1.08	2.63
S.	0.03	1.03	0.03
Total	100.18	99.75	99.67
Fe	68.87	67.12	63.76
P.	0.013	0.466	1.148

The analyses represent the average composition of some thousands of tons of ore from each of three mines.

The Ore Bodies.

"Most of the ore bodies have a roughly lenticular shape, and they are distributed over the field so as to form several ore-bearing belts.

"The ore supply has been estimated at 270,000,000 tons for the whole ore field, considering the depth to be 1,600 feet below the datum level of Walkomman, or 1,250 below the present average surface of the ores. The quantity, here, consequently, is only about a third of that of the ore deposit at Kiirunavaara.

"The shape, size and dip of the ore bodies have been decisive for the mining methods in practice. Hitherto, open-quarrying methods have been prevailingly used, but on account of the dip of the ores, these methods must at deeper levels be replaced by underground mining. If no regard is taken to the necessary removing of the hanging wall, the relative output of ore is essentially dependent on the intermixed dike rocks and varies in the different mines generally between 60 per cent. and 90 per cent. If the necessary blasting away of the hanging wall is also taken into consideration, the percentage of ore sinks considerably and does not for the field taken as a whole much exceed 55 per cent. of the total, nearly the half of which, consequently, consists of sterile rock and ore containing too little iron to be at present valuable."

. . . . .

The Government is harnessing water falls in order to supply the railway and the mines with electric power. At first 50,000 h.p. is to be developed. A total of 300,000 h.p. can be developed if required. The railway will be operated by electric power for a distance of about 150 miles from the water falls. Railway operators in Canada, where conditions are so similar in many ways to those of Sweden, should be able to gain some useful information from this Swedish railway.

As stated above, iron ore from Kiruna and Gellivare is shipped to various countries, including the United States. A few years ago ore was shipped from Gellivare to Sydney, N.S., and coal cargoes were sent to Sweden in return.

It was interesting to see American machine drills in use at these mines. The ore trains carry just half the quantity those on the Mesabi range do.

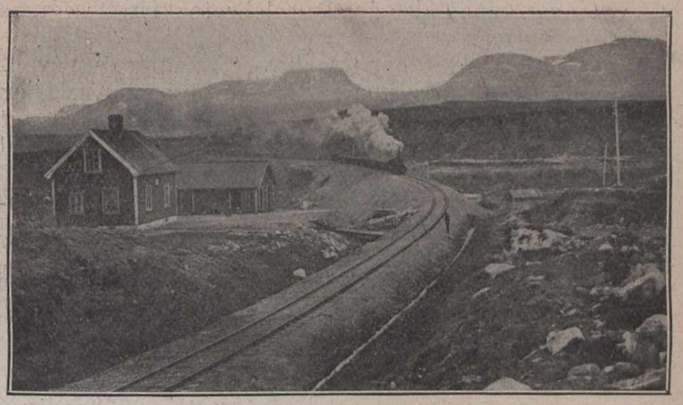
The mining towns contain on the whole a better class of houses and are much cleaner than those in most North American mining fields. Everything considered, one is inclined to say that the miners in Northern Sweden are at least as well off as are their brethren in the better

class mining camps on this continent. Drill runners get about $2.00 a day, and ore-loaders about $1.50. Their expenses are, however, considerably lower than they would be in America. For instance, they pay, at Gellivare, only about one dollar a month rent for a house, but this is shortly to be raised to $3.50. Master-mechanics and other employees of similar standing who have served the company for 20 years or more are given a pension of $250 a year. Allowances are made to men who are incapacitated through injuries, and a system of insurance similar to that in Canadian mines is in force for the employees. The government inspector, I was told, visits the mines at Gellivare once a year.

Space has not permitted reference to many interesting points in connection with the geology, the ore bodies and the methods of mining at these great mines. Readers who wish details should consult the splendid volumes on "The Iron Resources of the World," edited and published by the Swedish committee of the Congress.

Kiruna to Narvik

During this stage of the excursion we had an opportunity of visiting very interesting geological localities, where we saw pre-Cambrian and later rocks, and one very striking thrust plane. This part of the trip, moreover, appealed to the members of the party owing to its being under Arctic conditions. The tree line came down to the railway in places, and the glacier-covered and snow-capped mountains, together with the more level treeless tracts, presented a scene which will long be remembered by the members of the party. Dawson City is south of latitude 64. The railway on which we travelled, the most northern in the world, passed through latitude about 68.50. At Narvik we were shown the town, which has been built up in a somewhat desolate region (though attractive in summer) in a few years owing to its being the shipping point for the ore from Kiruna. We visited the docks and saw the methods employed in sampling and loading the cargoes. By the way, some members of the party discovered that white bear skins were very cheap in Narvik and a number were purchased.



Railway in Lappland

While on the trip from Kiruna to Narvik we were under the leadership of Dr. P. J. Holmquist, another Swedish geologist for whose scientific attainments and personal qualities we had the highest respect and admiration.

Narvik to Trondhjem to Stockholm.

From Narvik we took a steamer down the coast of Norway to Trondhjem. I shall not attempt to describe the scenery of this coast. Its fiords, mountains, glaciers and islands together form one of the most celebrated regions of the world for the tourist, and it has been well described by many writers.

Leaving Trondhjem by train for Stockholm, we passed through an interesting country. Space, however, prevents my referring to this part of the journey, except to say that one town we passed through is famous among English-speaking travellers because its name is H——.

Lest what I have already written weary my readers, I shall close without describing the sessions in Stockholm or the excursions of the Congress. In another number of the JOURNAL I will take up these subjects.

Before closing, I wish to say that we were most favourably impressed with Sweden as a country and with its people. Canadians, especially, can learn much from Sweden as regards the industries of agriculture, mining

A Scene on the Coast of Norway

and forestry. It is also justly celebrated for its educational institutions.

At another time I hope to have the opportunity of expressing more fully in writing my high appreciation of the kindness shown to us, and of giving an account of the splendid organization the Swedish geologists had for the Congress.

The next Congress is to be held in Canada, on the invitation of the Dominion, the Province of Ontario, and the Canadian Mining Institute.

THE PREVENTION OF MINE EXPLOSIONS

(Continued from last issue)

Where current at a potential of more than 650 volts is employed for transmission underground, it should be transmitted by means of a completely insulated cable; and where a lead or armoured covering is used, such covering should be grounded.

In all mines having electric installation special precautions should be taken against the setting on fire of coal or timber. Enclosed fuses or cut-outs are recommended, and each branch heading should be so arranged that the current may be cut off when necessary.

No live electric wire should be permitted in that part of any mine in which gas is found to the amount of 2 per cent.

In all mines producing gas in dangerous quantities, as indicated by a safety lamp which will detect 2 per cent. of gas, the working places should be examined for gas by a qualified man, using such a lamp, immediately before any electric machine is taken or operated there.

H.—Precautions against Miscellaneous Accidents.

(1) In all new construction, shaft lining and superstructures about the entrance of the shaft (or slopes or drifts) should be built as far as practicable of non-combustible materials.

About the entrances to mines every possible precaution should be taken to prevent fires or the injury of the equipment for ventilation and haulage. Ventilating fans should be placed at one side of the mine opening, and hinged doors or light timbering should render easy the escape of the explosive force in direct line of the shaft or slope.

Proper precautions should be taken for immediately preventing the entrance into the mine of heat and gases and for facilitating the escape of the men in case of surface or shaft fires.

(2) The surface equipment for handling the coal should be so arranged as to prevent coal dust from entering the mine shaft.

(3) In all new mines, and in all old mines as far as practicable, suitable main roads should be provided for the men separate from the main haulage roads.

(4) In connection with the system of ventilation it is recommended that in the more frequented roads connecting the intake with the return air coures, two doors be provided, these doors to be placed at such a distance apart that while one is open the other is closed.

(5) In view of the large number of accidents from falls of coal or roof, under the existing practice with single props, more attention should be given to the introduction in mines where the roof is bad of better systems of timbering, such as have been long in use with economy and safety in many well managed mines.

(6) In undercutting coal by hand, the premature fall of the coal should be prevented by sprags or other suitable supports.

(7) We believe that the difficulties and dangers encountered in the working of coal seams which are thick and steeply pitching, or of which the coal is highly inflammable in character or subject to firing from spontaneous combustion, and in mines where the subsidence of the surface must be avoided, may be successfully and economically overcome in many cases through the adoption of the flushing system of mining—that is, the filling with sand or other similar materials of the space from which the coal is removed. This system originated in the United States and is now successfully practiced in portions of Germany, Austria, Belgium, and France.

I.—Mine Supervision and Inspection

(1) We cannot too strongly emphasize the fact that thorough discipline about the mine is absolutely essential to safety, and that thorough discipline can be brought about only through the hearty co-operation of the operators, the miners, and the State.

(2) We are of the opinion that the responsibility for safety in the mine should primarily rest with some person, such as the manager or superintendent, clothed with full authority; and that such person can greatly facilitate the attainment of safety through the employment of a sufficient number of foremen, and also of one or more inspectors whose special duty it shall be to see that the regulations are strictly enforced.

(3) The State cannot exercise too much care concerning the experience, technical training, and selection of its inspectors. Their positions should be made independent of all considerations other than that of efficiency; and their continuance in the service should be co-existent with good behaviour and proper discharge of official duty.

J.—Training for Mine Firemen, Inspectors, etc.

We are of the opinion that the cause of both safety and efficiency in coal-mining in the United States would be greatly aided through the establishment and maintenance in the different coal regions of special schools for the training of fire bosses, mine foreman, superintendents, and inspectors. The instruction in such schools should be practical rather than theoretical.

The work of these schools would supplement most effectively that of the colleges already established in many parts of the country for the more thorough training of mining engineers.

THE DOLCOATH'S NEW SHAFT

After many years' work, the new vertical shaft at the Dolcoath mine has been completed to a depth of 3,000 feet. This shaft is circular and is lined with bricks from top to bottom. The hauling and pumping arrangements have still better ventilation, which is much needed in the lower levels of the mine. The system of rail guides is being adopted in the shaft, on which two cages will run, and these cages are so designed that they will automatically tip the wagons each of 30 tons capacity, put in them. The making of connections to the Williams shaft entailed a great deal of work which interfered with returns. Perhaps in the course of many years this shaft may warrant the large expenditure, but it has been a tedious and costly undertaking more suited to a coal than a tin mine.

The practice of filling old stopes with sand is becoming more general. At one German colliery about 1,300 tons of sand per day is washed through iron pipes into the stopes. The wear on the pipes is enormous. White porcelain and glass linings have been tried. The former is the better, though both wear out within a few months. At one mine no lining is used, the pipes being patched by means of oxy-hydrogen flame.

THE BRIQUETTING OF IRON ORES

BY CHEVALIER C. DE SCHWARZ (Liège).

(Paper read before the Iron and Steel Institute.)

GENERAL REMARKS.—The question of briquetting iron ore is one which becomes of increasing importance every year, not only owing to the fact that iron ore in general, and lump ore in particular, are becoming more and more scarce, at least in Europe, but also because of the severe conditions imposed by modern blast-furnaces; not only in regard to the chemical composition, but also to the physical condition of the ore.

The use of improved and more effective explosives in the iron mines, as well as the fact that iron ores have to be transported over long distances and frequently reloaded before they reach their destination, tend to increase the percentage of small and dust ore, to the disadvantage of blast-furnace working which—on account of the greater height of the furnaces themselves, the high pressure of blast, and the use of blast-furnace gases for gas engines—require an ore which is not too fine nor too dusty.

The blast, being of comparatively high pressure in modern blast-furnaces, will naturally blow out a considerable portion of the fine ore, which will mix with the escaping blast-furnace gases, causing well-known inconveniences. This is the more objectionable, as the blast-furnace gases are now, almost everywhere utilized for driving gas-engines, for which purpose the gas must be almost entirely free from dust.

The fine ore, during its downward passage in the blast-furnace, advances quicker than the lump ore, charged at the same time; consequently it is not exposed long enough to the beneficial reducing influence of the carbon monoxide gas arising from below. It therefore leaves the zone of reduction in the blast-furnace imperfectly freed from oxygen, and, as a consequence, clogs together as soon as it reaches the zone of carbonization, causing scaffolding, and even explosions.

A considerable number of methods for briquetting iron ore have been brought out, but none as yet that can be applied generally with success. A few of the methods introduced into practice have proved successful, but only for certain kinds of ore, or in local circumstances and conditions. Some methods which have yielded favourable results with a particular kind of ore, have entirely failed with other ores. Experience has also shown that the method to be adopted must be modified to suit the nature of the ore, not alone with reference to its physical condition, but more especially with regard to its chemical composition. Most of the different methods which have been tried for briquetting fine-grained ore have proved to be too expensive, not alone with reference to initial outlay and cost of manufacture, but also, indirectly, on account of the great reduction of the contents of iron in the ore which occurs owing to too great an addition of building material.

The conditions for successful briquetting are:

1. The iron ore briquettes must have a certain resistance against mechanical influences. They must resist a pressure of not less than 2,000 pounds per square inch, and, when dropped from a height of 10 feet on a cast-iron plate, they must not fall into dust although they may break into pieces.

2. They must resist heat. Heated to 900 degrees C. they may commence to sinter, but they must not disintegrate into small fragments.

3. They should be capable of being placed in water for a certain time without softening.

4. They must resist the influence of steam at 150 degrees C. without crumbling.

5. They must possess a certain amount of porosity in order to allow the carbon-monoxide in the blast-furnace to penetrate the interior of the briquette and to exercise its beneficial reducing influence.

In order to test the briquettes for porosity, they are, after being dried, placed for about twenty-five minutes in water, during which time they ought to absorb not less than 12 1-2 to 16 per cent. of water, according to the nature of the ore.

6. The binding medium, if any is used, should not contain noxious substances (sulphur, arsenic) to such an extent as to be injurious to the quality of the pig-iron produced.

7. The cost of producing briquettes should not exceed the difference in the prices between lump ore and fine ore.

The different systems of briquetting ore can be divided into those in which a binding medium is used and those in which no binding medium is used. The former may again be divided into methods employing inorganic and organic binding materials respectively.

BRIQUETTING WITHOUT A BINDING MEDIUM.—In most of the cases, where no binding medium is used, the briquettes have to be heated at considerable expense, but there are exceptional cases where no heating is necessary notwithstanding that no binding medium is employed. This case presents itself where the iron ore contains a certain percentage of clay, because in such cases it contains in itself a binding medium. Clay iron ore and bean ore are instances.

At Kertsch, in Russia, where bean ore is briquetted, the latter is mixed with 8 per cent .of water and made into briquettes under a pressure of about 5,600 pounds per square inch. At Ilsede, in Germany, where clay iron ore is used, it is mixed with the waste of the iron ore washing plant and with other powdery waste products coming from the rolling mills and containing sufficient iron. The mixture, which is not allowed to contain more than 6 per cent. of water, is heated to about 75 degrees C. and pressed into briquettes, the pressure being about 4,000 pounds per square inch. In both the above cases no heating of the briquettes is necessary, and no binding medium is used.

The results obtained at Kertsch and at Ilsede naturally suggest the addition of common clay to other iron ores (containing no clay) as a binding medium in order to make briquettes by means of a cheap medium, and without going to the expense of heating the briquettes. However, it has been found that—in order to achieve the desired result—it is necessary to add a comparatively large percentage of the clay to the ore, thus indirectly reducing its contents of iron to too great an extent. Common clay contains, moreover, a high percentage of silica, requiring extra additions of limestone. The practice of using clay as a medium has therefore been abandoned, and it is only employed in cases where ferruginous clay is at disposal.

In some cases it has been sought to avoid the use of a binding medium, as well as the heating of the briquettes, by employing very high pressures, rising gradually to 11,000 pounds per square inch, for making briquettes; but although the briquettes made in this way have been very firm and offer great resistance to mechanical influences, they expand when exposed to heat and fall to pieces; besides which they are too dense, and this considerably interferes with their reducibility.

Of all systems of briquetting iron ores without a medium, by heating the briquettes after they have left the press, the Grondal process, so called after the name of the inventor, has proved to be the most successful for magnetic ore.

The following is a short description of this process: the raw ore, containing 27 to 58 per cent. of iron, is broken up by means of a stonebreaker and then ground to sand in a ball-mill. From this sand the pure magnetic ore, the so-called "concentrate," is extracted by means of magnetic separators.

The "concentrate," containing from 67 to 71 per cent. of iron, is moistened and made into briquettes about 6 inches square and 2 1-2 inches thick, with rounded edges. No addition is made.

The briquettes are then laid in three rows edgeways upon small iron wagons and transported into a furnace heated with generator and blast-furnace gases. Heated and compressed air is supplied by means of a Korting blower in such quantity as to produce a highly oxidizing flame, whereby the magnetic ore (Fe_3O_4) is oxidized to peroxide of iron (Fe_2O_3). The sulphur is considerably reduced during this operation.

The following comparative table gives the chemical composition of the raw ores, concentrates, and briquettes in different cases:

	Raw Ores.					
Names of the Place	Fe per Cent.	S per Cent.	P per Cent.			
Flogberget	27.3	0.31	0.003			
Herrang	40.2	1.21	0.003			
Lulea	58.2	0.11	1.23			
Strassa	46.8	0.03	0.015			
Cornwall, U.S.A.	30.6	1.60	0.012			
	Concentrates.			Briquettes.		
Fe per Cent.	S per Cent.	P per Cent.		Fe per Cent.	S per Cent.	P per Cent.
67.4	0.04	0.003		65.3	0.007	0.003
67.3	0.17	0.002		65.5	0.003	0.007
71.1	0.015	0.005		69.3	0.005	0.005
69.2	0.015	0.003		67.1	0.005	0.003
69.9	0.036	0.003		67.9	0.010	0.005

One furnace, about 150 feet long and 5 1-2 feet wide, produces, on an average, 200 tons of briquettes in a week, the cost of production being given as 3s. 4d. per ton of finished briquettes, exclusive of general expenses and royalties.

The briquettes are hard and porous, and quite suitable for the blast-furnace; but the cost of production appears to be rather high, in consequence of which the Grondal process has not, except in Sweden, been much adopted. In Sweden there are at present twenty-seven Grondal furnaces at work, with a total output of about 300,000 tons of briquettes per year.

The reason why the Grondal process is of special value to Sweden lies principally in the fact that the working of the blast-furnaces in that country is almost entirely based on the use of charcoal. The slag of charcoal-furnaces being—for well-known reasons—acid, it does not absorb sulphur, consequently nearly all the sulphur in the iron ore goes into the pig-iron instead of into the slag. This is also the reason why the blast-furnace owners in Sweden object to use any iron ore containing more than 0.015 per cent. sulphur. From the above comparative table it will be seen that the raw ore contains considerably more sulphur than the above-mentioned limit, and it is therefore absolutely necessary to reduce the percentage of sulphur in the raw ore, not only by means of the magnetic separator, but also by heating the briquettes to a high temperature (given at 1,400 degrees C.) and in an oxidizing flame.

Although the percentage of iron in the briquettes is somewhat reduced, owing to the transformation of magnetite (Fe_3O_4) into peroxide of iron (Fe_2O_3), this advantage is more than compensated for not only by the expulsion of sulphur, but also by the fact that peroxide of iron (Fe_2O_3) is much more easily reduced and requires considerably less fuel in the blast-furnace than black oxide of iron (Fe_3O_4).

Considering that charcoal is becoming more and more scarce from year to year, and, as a consequence, more expensive, the question of economizing fuel is of special importance to Sweden.

Experience has shown that briquettes made of Fe_3O_4 (magnetite) require in the blast furnace 300 pounds more charcoal per ton of pig-iron than those made of Fe_2O_3, equal weights and percentages of iron being taken in each case. This difference in the consumption of charcoal represents a reduction in the working expenses of about 6s. 6d. per ton of pig-iron in favour of Fe_3O_2 against Fe_3O_4. The success of the Grondal process, notwithstanding its high cost, is therefore justified for Sweden, as well as in such other countries in which charcoal, together with sulphurous ores, have to be employed.

Considering that the melting point, and therefore the sintering temperature, of magnetite, is comparatively low, the briquettes made of "concentrates" (Fe_3O_4) begin to sinter and to harden at a temperature of from 800 degrees to 900 degrees C. However, as already mentioned, the temperature is raised to about 1400 degrees C., in order to expel as much sulphur as possible. It may also be mentioned that the process of converting the Fe_3O_4 into Fe_2O_3, being an oxidation process, is accompanied by a development of heat, thus economizing fuel to a certain extent.

The suggestion has been made of using briquettes made of "concentrates" directly in the open-hearth furnace, as a decarburizing and, at the same time, enriching addition to the metal bath.

The use of iron ore in the open-hearth furnace for that purpose is already well known, but such ore must be comparatively rich in iron, and it must not contain noxious substances to such an extent as to interfere with the quality of the steel produced. From the chemical analysis, given in the foregoing comparative table, it will be seen that the "concentrates" (and therefore the briquettes made therefrom) quite fulfil these conditions, the percentage of sulphur in the "concentrates" varying, with the exception of those from Harrang, between 0.015 and 0.04 per cent. Considering, further, that, as a rule, only 25 per cent. of iron ore is used in the open-hearth furnace, the contents of sulphur in the ore added will be indirectly reduced to one-fourth (0.004 per cent. to 0.01 per cent.) in the finished steel, which is not high enough to interfere with its quality. In the case of briquettes made, as suggested, from concentrates, for use in the open-hearth furnace, it would not be necessary to heat them up to 1,400 degrees; it would

also not be necessary to oxidize them from Fe_3O_4 to Fe_2O_3, and to make them porous. For use in the open-hearth furnace they can be pressed at a considerably higher pressure whereby they would become more compact, which is more advantageous for use in the open-hearth furnace, because they will then be specifically heavier, and therefore sink deeper in the bath, instead of floating upon the surface for a long time, like red or brown iron ore, which, with the exception of specular iron ore, is comparatively much lighter in weight.

As Fe_3O_4 commences to sinter at a temperature of from 800 degrees to 900 degrees C., the briquettes made of "concentrates" will become hard at this temperature, and need not be heated above it. This advantage, together with the fact that they need not be porous (and therefore not changed from Fe_3O_4 to Fe_2O_3), makes the briquettes considerably cheaper and richer in iron when used in the open-hearth instead of in the blast-furnace.

In order to avoid the cost of briquetting, an attempt has been made to agglomerate the fine-grained ore in a rotary furnace. This method appears to be of special value in cases where the agglomeration can be combined with the roasting of the ore, should the latter be necessary or advantageous, as, for instance, when spathic ore, brown iron ore, or iron ore with a high percentage of sulphur is to be agglomerated.

The fine-grained ore to be agglomerated in a rotary kiln is mixed with coke-dust (which can generally be procured very cheaply) in order to reduce the oxygen in the ore. The Fe_2O_3 in the ore can thus be partly changed into FeO, which would enrich the ore in Fe, and, at the same time, reduce the temperature necessary for agglomerating.

Considerable difficulties have, however, been experienced with this method of agglomeration. First, it has been difficult to regulate the temperature in the rotary furnace in such a way that the necessary sintering should take place without melting. Secondly, it has been found that the ore, as soon as it commences to agglomerate, adheres to the inner fireproof lining of the rotary furnace, thus causing scaffolds, which have to be be removed at considerable expense.

These difficulties are more frequently experienced in cases where coal-dust firing is employed for heating the rotary furnace, because, in these cases, the ashes of the coal, consisting chiefly of silica and alumina, mix with the ore and cause scaffolds, besides indirectly reducing the contents of iron in the agglomerated ore. The use of gas instead of coal-dust firing may therefore prove advantageous in this case, partly because the temperature in the rotary furnace can be more easily regulated according to requirement, and partly because no ash becomes mixed with the ore.

Briquetting by Means of a Binding Medium.—The use of slaked lime as a binding medium for fine-grained ore has been known for many years, and it has also been found that briquettes quite suitable for blast-furnace use can be made when the slaked lime is mixed with some granulated basic slag. Compared with other methods this process of briquetting is rather expensive and also considerably reduces the percentage of iron in the briquettes, because from 7 to 8 per cent. of binding material, containing no iron, has to be used. Besides this, the briquettes have to be exposed for a considerable time to fresh air in order that the calcium oxide in the briquette may absorb sufficient carbon dioxide, because hydrate of lime as such would lose its water in the upper portion of the blast-furnace, and the briquettes would therefore crumble to dust. The transformation of CaO into $CaCO_3$ also means another indirect reduction of the percentage of iron in the ore, not to mention that a great amount of space and extra labour are required for stacking and keeping the briquettes, in order that this transformation takes place. This method of briquetting ore has therefore not found extensive application.

Burnt lime, either alone or mixed with clay or ashes, has also been tried, but without success. This may easily be understood from the fact that—owing to the presence of steam and carbonic acid in the upper portion of the blast-furnace—burnt lime absorbs water and carbonic acid, thus changing into hydrate of lime. These reactions—being accompanied with a certain evolution of heat—cause "upper heat," a serious inconvenience known to every blast-furnace manager. Besides these there are other disadvantages attending the use of lime. Gypsum, as well as cement, has also been tried as a binding medium. The former contains too much sulphur, and neither resists the influence of heat, although the briquettes withstand humidity as well as mechanical influences.

More success has been achieved by using as a binding medium a mixture of sand and slaked lime. Equal parts of these materials are mixed and ground into fine powder, and then intimately mixed with the dust ore. After being moistened the mixture is pressed into briquettes, charged into boilers, and exposed for some hours to the influence of superheated steam under pressure, after which the briquettes are ready for the blast-furnace. About 6 per cent. of the above-mentioned binding medium is required.

This method of briquetting iron ores depends on the fact that the silica in the sand—owing to the influence of superheated steam—is converted from the insoluble into the soluble condition, ready for combination. This method has given very good results in respect of the quality of the briquettes produced, but it has not found very general practice on account of its high working expenses as well as its high initial outlay.

Another method of briquetting, based on the same principle, consists in the use, as a binding medium, of basic blast-furnace slag, which was exposed to steam pressure as mentioned before. However, as nearly 10 per cent. of this medium is required to obtain good briquettes, it has been found that the percentage of iron in the ore becomes too much reduced.

Spathic ore, mixed with lime, is also successfully used as a binding medium, provided that the briquettes are exposed to steam pressure for a certain time. This process is based on the fact that hydrate of lime and carbonate of iron (spathic ore), when intimately mixed and exposed to steam pressure, become converted into hydrated ferrous oxide and carbonate of lime (limestone). The former, being of a gelatinous nature ,serves as a binding medium and changes, later on, into hydrated sesquioxide of iron. This process is carried out in the following manner: A mixture of two parts of spathic ore with one part of lime, reduced to powder, is prepared. Of this powder 15 per cent. is added to the ore to be briquetted, the whole moistened—whereby the lime is converted into hydrate of lime—and made into briquettes under a pressure of about 6,000 pounds per square inch. These briquettes are packed—edgewise—on wagons, after which they are charged into boilers where they are exposed to a steam pressure of eight atmospheres for a period of 4 1-2 to 6 1-2 hours. In case spathic ore alone is to be briquetted an addition of 6 per cent. of lime is sufficient. In the latter case cylin-

drical briquettes of about 5 1-2 inches diameter and 4 1-2 inches in height are generally made.

The briquettes made according to this method are very good, but expensive, besides which that plant requires a comparatively high initial outlay.

Great success has been obtained in briquetting blast-furnace flue-dust, which is principally due to the fact that this by-product already possesses hydraulic properties, because—like cement—it contains lime, alumina and soluble silica ready for combination. In addition to this it has been found that by adding certain salts, such as chloride of magnesium, chloride of calcium, green vitriol ($FeSo_4 + 7H_2O$), or acids, such as sulphuric or hydrochloric acid, those hydraulic properties can be raised to such a degree that very suitable briquettes can be made from the dust.

Of these additions chloride of magnesium ($MgCl_2$) has been found to be, generally speaking, the most suitable, because it is cheap (being a by-product in the manufacture of certain artificial manures), and because it does not contain any noxious substances. Owing to the high temperature in the blast-furnace, the chloride of magnesium is decomposed into magnesium and chlorine. The former enters into the blast-furnace slag as MgO, and the latter combines with hydrogen to form hydrochloric acid. The acid further combines with the free lime to form chloride of calcium, which is finally absorbed by the water used for washing the blast-furnace gases. In some instances it has been observed that the iron portions of the furnace top become slightly attacked, which is ascribed to the presence of sydrochloric acid not fully neutralized.

This process of briquetting, called after the inventor the "Schumacher" process, has given very satisfactory results, not only with reference to the quality of the briquettes produced, but also as far as cost of production and initial outlay are concerned. It must, however, be pointed out that the blast-furnace flue-dust used for briquetting, must be used almost immediately after having been removed from the catchers, and that, like cement, it must be protected against humidity before briquetting. The installation for briquetting flue-dust should therefore be situated in the close proximity of the blast-furnace from which the flue-dust is taken.

It is to be regretted that this process can only be used for briquetting blast-furnace flue-dust. With the exception that in some instances where the chemical composition of the flue-dust is particularly favourable to the purpose, an addition of about 40 per cent. of purple ore to the flue-dust has been found to be admissible; the latter thus acting, as it were, as a binding medium to the former.

Another method of briquetting flue-dust consists in the use of basic blast-furnace slag, after having been exposed to steam pressure. Owing to the influence of compressed steam the silica in the slag changes from the insoluble to the soluble variety, and combines with the lime in the flue-dust to a kind of cement, which acts as a binding medium. If the lime in the flue-dust is insufficient, another 4 to 4 1-2 per cent. is added. The briquettes made in this way are quite suitable; but taking into consideration that from 8 to 12 per cent. of binding medium, containing no iron, has to be used, the contents of iron in the briquettes is too much reduced to make this method profitable.

Organic matters, such as the waste lye, resulting (as a by-product) from the manufacture of sulphide cellulose, and molasses have been used for briquetting flue-dust as well as other iron ores. In the former case, the lye is concentrated to a syrup, thus constituting a kind of pitch, called "Zellpech" ("cellulose-pitch") in Germany, where it is used. On an average, about 6 per cent. of this binding medium is intimately mixed with the flue-dust or ore, and pressed into briquettes under a pressure of not less than 9,000 pounds per square inch. The briquettes made with "cellulose-pitch" are suitable, but, as the binding medium is very expensive (40s. a ton), the financial success of this method is rather doubtful.

The use of molasses as a binding medium was tried for briquetting the ferriferous residues of the aniline manufacturing process, as well as for briquetting flue-dust—this process being as follows: One part of cheap molasses, by volume, is mixed with two volumes of silicious sinter ("Kieselguhr"), 0.4 parts by volume of carnallite and 100 parts by volume of the ore, to be briquetted. The briquettes are allowed to dry in the open, after which they are charged into the chambers of an annular furnace, such as is used for burning ordinary bricks. Here they are heated up to 1,000 degrees C., when they begin to sinter and to harden.

This method of briquetting is accompanied by high working expenses and considerable initial outlay. The employment is therefore only justified when the by-product of the aniline manufacturing process, containing about 67 per cent. of iron, is to be made into briquettes.

As before mentioned this process was also tried for briquetting blast-furnace flue-dust, but it was abandoned, probably on account of the too high cost.

Besides the above-mentioned methods of briquetting fine-grained ores, or blast-furnace flue-dust, etc., there are numerous other methods of briquetting with or without a binding medium. In the former case soluble glass (alkaline silicate), asbestos, basic slag, naphtalin, paraffin, resinous soap, as well as other inorganic and organic materials, are used, and in the latter case smelting is conducted in a reverberatory furnace. Treatment with liquid iron, or in an electric furnace, has been proposed and also tried in practice, but in all cases without result. As there is also no reason to believe that these methods will ever be tried again, the author does not consider it necessary to go into details about them.

Conclusions.—From what has been said it may appear that a universal method of briquetting fine iron ore, fulfilling the conditions enumerated in each case, has not been invented as yet, and probably never will be.

Taking the financial results of the different methods of briquetting into consideration, it is found that the methods of briquetting practised at Kertsch, in Russia, and at Ilsede, in Germany, appear to be the most economic, the working expenses, as reported, amounting only to one shilling per ton of briquettes. As already previously mentioned, this method can, however, only be applied successfully when the ore contains sufficient hydrate of alumina to serve as a medium.

The manufacturing expenses of briquetting by the Grondal process amount to 3s. 4d. per ton of briquettes, exclusive of general expenses, redemption, and royalties, for which at least 1s. 4d. will have to be added, thus resulting in a total expense of 4s. 8d. per ton of briquettes. This would be far too high to allow of the general introduction of this process. However, the Grondal process is of particular value for Sweden, where its use has become almost unavoidable in order to be able to utilize the iron ore of that country; besides, its use is, in Sweden, combined with a saving of 6s. 6d. per ton briquettes in fuel, thus resulting in a final saving of

1s. 10d. (6s. 6d. — 4s. 8d.) per ton in favour of the Grondal process. Similar results may also be obtained with this process where charcoal is used as fuel in the blast-furnace.

Of all the different methods employed for briquetting blast-furnace flue-dust, the "Schumacher" process has given the best financial results, the cost of briquetting according to that method, amounting to 1s. 8d. per ton briquettes only, without royalty.

The other methods of briquetting iron ore flue-dust and other ferruginous residues of other industries, as described before, have given less favourable financial results, the cost of briquetting amounting from 2s. 6d. to 3s. 9d. per ton briquettes. Besides this it must be mentioned that where a binding medium is used, on an average about 7 per cent. is required to be added to the ore, thus reducing considerably the percentage of iron. In several cases it has also been found necessary to stack the briquettes for several weeks in the open before they could be used, thus requiring a good deal of space and extra labour for transporting and handling.

Finally, it may be mentioned that at present an establishment for making briquettes is being erected at a Belgian works according to a new process recently introduced. According to this method from 2 1-2 to 4 1-2 per cent. of binding medium, costing about 16s. a ton, is used. The initial outlay for a plant turning out 5 tons of briquettes an hour, amounts to about £2500, and the manufacturing expenses, inclusive of general expenses, to 1s. 6d. per ton briquettes. The briquettes fulfil all the conditions enumerated previously, and can be used within twenty-four to thirty-six hours after having left the press, no heating or any additional work being necessary. By this method, not only fine ore, but also rolling-mill and forge-scale (Fe_3O_4) have been briquetted with success, the latter having been successfully used as an enriching and decarbonizing addition in the open-hearth furnace.

NORTHERN PARTNERSHIP GROUP, ATLIN MINING DIVISION, B.C.

Last month the CANADIAN MINING JOURNAL published a contribution by E. Jacobs on the Engineer group, Atlin, B.C. The subjoined description of the Northern Partnership group, formerly the Engineer group, is from a bulletin recently issued by the Bureau of Mines, British Columbia, and written by Mr. Herbert Carmichael, Provincial Assayer, who recently visited the property.

"This property is better known by its old name of the Engineer Group. The claims now included in the group are Engineer No. 1, Northern Partnership No. 1, Northern Partnership No. 2, Northern Partnership No. 3, Haddon, Big Engineer Fraction, Little Engineer Fraction, Plato, and Mickey. The owners are the Northern Partnership Syndicate, with head office at Atlin, B.C. The mines are situated on the east side of Taku Arm of Tagish Lake, ten miles farther up the lake than Golden Gate, in Atlin District.

"This property, then known as the 'Engineer Group,' was reported on by the Provincial Mineralogist in 1904; since then it has changed hands, having been purchased by the present owners in 1907. The country rock on this group of claims is slate, cut by igneous dykes and traversed by numerous quartz veins, some mere stringers and others up to 30 feet wide. A very considerable amount of surface prospecting and development of these veins has been done, consisting of numerous open cuts and shots put in at different points; in all cases this work has shown up clearly defined quartz veins, traversing the slate formation, cutting through both the country rock and the dykes before referred to. The general strike of the country rock is N. 65 degrees W., with a dip of 35 degrees to the northeast; the majority of the dykes seem to have a strike of 15 degrees farther north, but to have a much greater dip, being 80 degrees to the southwest. These dykes are clearly marked, as owing to their harder nature they have been left standing, while the softer slate rock has been eroded away. The main quartz veins seem to have a general strike of about N. 10 degrees W., and a dip of 70 degrees to the east, but there are numerous cross-veins whose dip and strike vary considerably. The actual mining done by the present owners has been confined to the smaller quartz veins from 6 inches to 2 feet wide; the ore from these veins yielding high values in free gold and tellurides. According to the statement of the owners, 800 pounds of the selected ore yielded 240 ounces of gold, and from the appearance of this ore, which is in places crusted with free gold, there does not seem any reason to doubt the statement.

"The larger veins are being opened by shots and cross-cuts and are said to give values from $20 to $100 per ton, but as yet none of this ore has been run through the mill, and until such test has been made it is impossible to form any safe idea of their value. The quartz looks good; the veins are clearly defined and have been traced for considerable distances; they can be easily worked, so there is a fair prospect that they will yield good, if not high, returns.

"From the shore of the lake the ground rises abruptly to a bench some 500 feet above the lake; this bench goes back some distance, when the mountains rise to snow-capped peaks 4,500 feet high. At 300 feet above the lake a quartz vein has been worked by two open cuts, one a little below the other and having a total length of 170 feet; in these cuts the vein is clearly defined and has an average width of about 2 feet 6 inches, the quartz carrying a considerable amount of calcite and showing free gold in both the quartz and the calcite, with specks of tellurides through the former. The ore is generally straight quartz with calcite, but in places it is a slate breccia which has yielded high values from the thin intersecting seams. The ore from these open cuts is being carefully sacked and hauled to the stamp-mill on the shore of the lake and forms the base of the present ore-supply.

"A short distance to the northwest a small cross-vein, running towards the vein just mentioned, is being worked by an open cut, and similar ore has been taken out. About 1,000 feet south of the large open cuts and at 100 feet lower altitude is what is locally known as the 'South Vein.' This is a brecciated quartz vein 6 feet wide with well-defined walls, but as yet no work has been done on it. A small cross-vein runs from this vein to the lake, and from the lake shore a tunnel is being started which will follow the strike of the vein, which at this point is some 18 inches wide and carries a very large proportion of calcite with free gold crusted in the solid calcite. Work was commenced on this vein as it showed high values, was close to the stamp-mill, and easy to work.

"On the Big Fraction claim, 2,000 feet north of the large open cuts and 500 feet above the lake, what may be called the main vein has been uncovered by a few shots. This is a quartz vein with a north and south strike and including an amount of slate breccia; the width of this vein is still undetermined, but may be taken as at least 30 feet, while it has been prospected by an open cut 1,000 feet farther north and traced still farther through several claims. It is proposed to run a

few tons of this ore through the mill to ascertain its value, which is at present unknown.

"About 100 feet back of the shore line and 100 feet above the lake is a quartz vein of undetermined width, but probably 8 to 10 feet wide; to cross-cut this vein the former owners ran a tunnel in 150 feet and did some 150 feet of drifting. They did not get in far enough to cut the ledge seen above, but cut a number of small stringers which they drifted on, in one place cutting through about 10 feet of quartz-slate breccia which may have contained values. The present owners intend pushing the tunnel till the vein is reached.

"A short distance to the south, where this vein outcrops on the lake shore, the former owners sunk a shaft said to be down 70 feet, but now full of water, and no data were obtainable from it. Close to this shaft on the lake shore a two-stamp mill was set up in March of this year and commenced running in June on the rich ore from the open cuts, yielding, as stated, 240 ounces of gold from 800 pounds of ore treated; lower grade quartz was being run through on August 5th, and said to be yielding $100 per ton.

The plant consists of two heavy stamps and a double-discharge battery running over two amalgamated plates; a vanner is being set up to save the concentrates, which at the present time are largely going into the lake. Power is furnished by a small engine and boiler, but when a larger plant is installed ample water power is to be had from a stream near the mill.

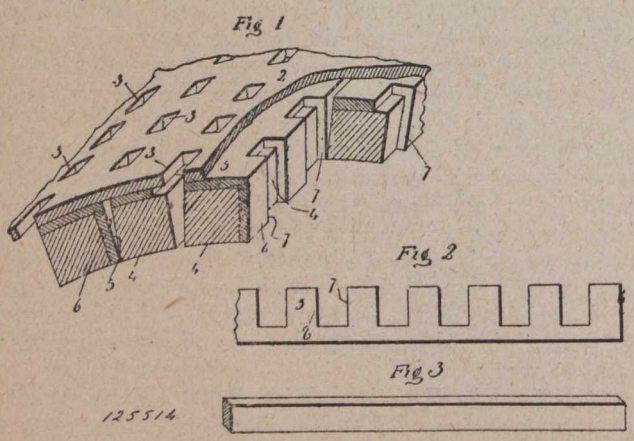
Summary.

The property contains a number of small quartz veins carrying high values in free gold, which give good returns under the present primitive method of working. There are larger veins, which, with a well-equipped plant and economical methods, would probably yield a large tonnage of lower grade quartz which would pay for treatment; these veins should first, however, be prospected and carefully sampled.

CANADIAN PATENTS.

Byran LaPort Morrison, assignor, and Joseph Wesley Ady, assignee of a third interest, both of Colorado Springs, Colorado, U. S. A., 10th May, 1910; 6 years. Filed 11th April, 1910. Receipt No. 181,835.

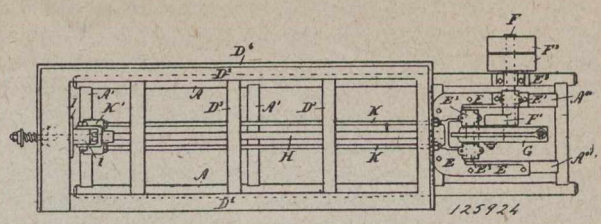
No. 125,514. Tube Mill. *Moulin à tubes.*



Claim. A tube mill comprising a barrel having a feed opening at one end and a driving head at the opposite end, the ends connected by a shell having a series of perforations, a lining comprising rectangular bars, notched strips between the bars and shell, said strips formed with flanges turned downward between the bars and having the notches therein registering with the perforations in the shell.

William Henry Roughsedge, Ottawa, Ontario, Canada, 24th May, 1910; 6 years. Filed 14th August, 1909. Receipt No. 173,328.

No. 125,924. Gold Saving Table.
Table à obtention de l'or.



Claim.—1. In a gold saving table the combination of a bed frame, a table with a top sloping longitudinally and transversely, having longitudinal rollways supported on wheels and axles journalled on said bed and having its transverse slope adjustable, a driving shaft journalled upon the upper end of said bed frame and having a crank, a bell crank lever pivoted adjacent to and operated by said crank, a pitman pivoted to said bell crank lever at one end and to the lower end of the table, a bumper head at the lower end of the table, a stop secured yieldingly to the lower end of the bed frame and connected to the upper end of the said frame by bolts against which stop the bumper head impinges, means of adjusting the transverse slope of the table, a table top mat having a plain rear space and plain lower end space and oblique and varying ridges and channels, a feed box at the upper end and rear of the table, a wash water box at the rear of the table, a launder at the front edge of the table and a receiver at the delivery end of the table, substantially as set forth.

PERSONAL AND GENERAL.

Mr. J. Mitchell Gordon has left the employ of the Fife Coal Company, Limited. His present address is in care of the Fanti Consolidated Mines, Limited, Tarquah, Gold Coast Colony, West Africa.

Mr. R. B. Lamb, mining engineer, made a professional visit to Gillies Limit on September 17th.

Dr. W. G. Miller returned to Toronto from Europe on September 16th.

Mr. J. H. Plummer has returned to Sydney from England much improved in health.

Mr. Frank Loring recently visited Porcupine.

Mr. G. M. Colvocoresses was in Toronto on September 15th.

Mr. J. W. Astley is shortly to open an office in Toronto. Mr. Astley was, until recently, consulting engineer to the Peterson Lake Cobalt Silver Mining Company.

Mr. J. T. Fee, formerly of Cobalt, is developing limonite deposits on the Mattagami.

Mr. J. B. Tyrrell has returned to Toronto from London, England.

Mr. E. T. Corkill has recovered fully from his recent illness.

Mr. T. W. Gibson, Deputy Minister of Mines for Ontario, visited Eastern Ontario mining districts early in September.

Mr. Critchley Parker, editor of the Australian Mining Standard, Melbourne, Australia, is touring Canada.

Mr. Herbert Carmichael, of Victoria, B.C., Provincial Assayer, has gone to England on a brief visit.

Mr. Clifford E. Smith is paying a professional visit to Tweed, Ont., where he is interested in iron pyrites properties.

Mr. M. S. Davys, managing director of the Kootenay Development Syndicate, and the Silverton Mines, Limited, both of which he organized in England, has returned to that country after a visit to West Kootenay district of British Columbia, in which he still has important mining interests.

Mr. W. C. Thomas, formerly manager for the Dominion Copper Company, which owned copper mines in the Boundary district, with smelting works at Boundary Falls, B.C., recently returned to British Columbia, and is now resident in Vancouver.

Mr. W. L. Coulson, of Vancouver, B.C., manager of the Canadian Collieries (Dunsmuir), Limited, lately examined some Rocky Mountain coal property, in Northwest Alberta.

Hon. Wm. Templeman, Dominion Minister of Mines, has returned to Victoria after having accompanied Sir Wilfred Laurier on his late tour through British Columbia.

Mr. Charles Graham has been examining the Nicola Valley Coal & Coke Company's Middlesboro' coal mines. He has been mentioned as likely to succeed Mr. James Gray as manager of the company's colliery in Nicola Valley, B.C.

Mr. O. S. James has resigned his position as chemist and assayer with the J. E. Wilkinson Company and is now open for engagement. His address is 227 George Street, Toronto, Ont.

Mr. D. P. Roberts, late chief electrical engineer for the City of London, Ontario, has been appointed by the Provincial Government inspector of electrical energy in British Columbia. This appointment interests mine and smelter owners, since purchased electric power is used at the larger smelters and some of the bigger metal mines in the province.

Mr. D. G. Macdonald, superintendent of the Dominion Lode Development Company, which is developing a quartz mine situated on the divide between Dominion and Lombard Creeks, Yukon Territory, is on a visit to his home at Oakland, California.

Mr. James F. Flynn, New York, has returned from an extended visit to Porcupine, during which he examined several properties and looked over the leading mines. Mr. Flynn speaks most encouragingly of the district.

A recent despatch from Washington says that President C. R. Van Hise, of the University of Wisconsin, is mentioned as a possible successor to Secretary of the Interior Ballinger. Dr. Van Hise is well known to Ontario mining men, as he has given considerable time to the study of the geology and ore deposits of this province. He and his associates have investigated the iron resources and the cobalt-silver deposits. In the United States he is well known for his work on pre-Cambrian geology and the Lake Superor iron region. Since becoming president of the University of Wisconsin, he has raised it to first place among the state universities. He is one of the leading apostles of conservation in the United States.

SPECIAL CORRESPONDENCE

NOVA SCOTIA.

Halifax.—The new report forms being issued by the Department of Mines of Nova Scotia promise to do good work. The "Coal Depletion Statements," as they are called, are placed before every colliery manager and every manager is required to fill them out accurately. The information that will be collected by means of these sheets will provide an annual inventory of the province's coal assets. Mr. Hiram Donkin, Deputy Minister of Mines, is responsible for this innovation.

Largely through the efforts of Mr. H. C. Borden, the Moose River tungsten deposits are being rapidly developed. Manager A. A. Hayward struck a new vein some weeks ago. Since then the discovery has shown up very well.

The Dominion Coal Company's outputs show a substantial increase over those of last year. Last year, of course, was marred by the strike.

The discovery of oil near Lake Ainslie, Cape Breton, has been confirmed. Much more work will be necessary to determine its value. A new hole is being drilled.

Activity in gold is increasing in both the eastern and western parts of the province. In Halifax County, four old mines have been re-opened during the past three months. To the west at least an equal number of antiguas have been brought to life.

Several inspections of the tin-bearing granite near New Ross, Lunenburg County, have been made lately. Parts of the outcrop are exceedingly rich.

The infusorial earth deposit near Bass River, Cumberland County, once the scene of a thriving industry, is being worked by a group of Oxford (Cum. Co.) investors, apparently with satisfactory results.

ONTARIO.

Cobalt, September 17th, 1910.—A large number of men have been prospecting all summer on various lots in the Gillies Limit, and, although several promising veins have been found, nothing really important has developed. The only properties that have found good ore are the Waldman and the Wyandoh. The discovery of the Waldman vein was the reason for the much higher prices that prevailed at the last sale. This is the same vein that is on the Waldman, and is the only one so far from which ore can be shipped. The Yorke-O'Brien also has a vein carrying medium grade ore, but this was traced across from the Red Jacket.

A number of good discoveries have lately been made on the Townsite, which have greatly increased its value. Trenching operations have resulted in the discovery of four veins near the boundaries of the Buffalo and the City of Cobalt. Two of these show a good width of high-grade ore, and the others show good ore in places. An extension of the ore shoot on the fifty-foot level of the main vein has also been opened up. It is believed that the property will shortly be in such shape that regular shipments can be made.

At the Provincial mine, the workings from the old shaft have been abandoned and operations in the future will be carried on from the new shaft, which was put down near the boundary of the Savage property. At the 175-foot level a station has been cut and a drift started on the vein, which at this point carries small values in silver. A cross-cut will shortly be started to open up No. 7 vein, which is running parallel.

In the northeast cross-cut on the third level of the Coniagas, two small veins have been cut. Since the new addition to the mill started running regularly this property has been concentrating a greater tonnage than any mine in the district, about 175 tons per day now being treated.

At a directors' meeting of the Temiskaming Mining Company held a short time ago, a very encouraging report for the month of August was presented. During that month 251,963 ounces were produced, 30,000 of which came from the concentrator, while the remainder was from high-grade ore from the 450-foot level. The total cost for the month's production amounted to

$22,014.63. The output for the first seven months of the present year is 1,103,693 ounces.

A remarkable case of stealing occurred recently at the Nova Scotia mine. The company had in its safe a number of bars of silver bullion, valued at approximately $18,000, which it intended to ship on September 7th. On the night previous the safe was broken into in a very daring manner, and all the silver was removed. The company immediately offered a reward of $1,000 for the return of the silver, and the local police, besides a number of private detectives, were soon working on the case. Before their investigations had proceeded very far, however, there was a split among the thieves as to the division of the loot, and one of them turned informer. As a result seven men were arrested and the whole of the silver recovered. Some of the thieves turned out to be employees of the company, while one of the others has been known for years to be a high grader, and was among those arrested in the case with Dr. Wilkinson.

The August shipments amounting to 3,099 tons, constitute the largest output for any month of the present year, and show an increase of 800 tons over the corresponding period of 1909. The total shipments for the first eight months of 1910 are 20,957 tons, which were produced by twenty-eight mines. Bullion shipments up to date amount to 343,163 ounces, produced from five mines. The shipments from Gowganda and Elk Lake for the same period total 435 tons.

An important deal has just been put through, whereby Mr. David Faskin has purchased the control of the Cobalt Power Company formerly held by Beech Bros. Mr. Faskin is president of the Hydraulic Company, and these two concerns have in the past been closely identified. In fact, the first electric power distributed to the mines in Cobalt was generated by the Hydraulic Company at its plant at Ragged Chutes and sold at wholesale rates to the Power Company.

Surface trenching on the Badger has lately been the means of uncovering two new veins. They are both in the Keewatin formation and carry low values in silver. In order to determine their value underground a cross-cut will be run from the first level of the No. 5 shaft. During the summer a total of 6,000 feet of trenching has been done.

Progress is being made with the new concentrator at the Hudson Bay mine. The capacity will be about fifty tons per day and some features that are new to the mills of the district are being installed. The concrete work is all finished and a good part of the frame is already up. All the machinery is on the road and will be installed as soon as possible. The company hopes to have the mill in operation about the first of next year.

On lot No. 1 in the Gillies Limit a vein carrying quantities of galena has been found. In places the ore is practically solid and it assays up to thirty ounces of silver to the ton. The owners will endeavour to ship a carload to Perth Amboy. A shaft has been sunk fifteen feet on the vein, and the ore is showing strong in the bottom.

The Black Mines have run short of funds and an effort is now being made to raise more money to carry on the development work. The shareholders are being asked to make a loan of $25,000 to the company, which will bear interest at the rate of seven per cent. and be payable in one year. The loan will be secured by the company's plant and property.

The management of the Buffalo mine has decided to increase the capacity of the cyanide plant so that it will be able to treat seventy tons a day. The capacity of the concentrator is not being increased, but some minor changes have been made in the flow sheet that will divert more of the tailings to the subsidiary plant. It is expected that the labour and power costs can be reduced and that a better extraction can be made. The consumption of cyanide per ton will also be less when the necessary changes shall have been made.

Recent developments in the vicinity of the No. 1 shaft of the Trethewey have been the means of opening up a large body of milling ore. Not enough work has been done on it as yet to determine its limits.

The Bailey management has decided to erect a small smelting plant for the ore which they purpose mining shortly. It will consist of two oil-burning furnaces, each holding six large crucibles. No details are as yet available as to the capacity, cost of operation and process of treatment. The experimental work was done by Mr. E. A. Benson, the president, who states that he has obtained good results. The economic working of such a plant for a small tonnage, is, however, extremely doubtful.

The Crown Reserve has decided to cut out shipments of low-grade ore, and to increase the machinery in the ore house so that in the future only high-grade ore will be shipped. The new vein found down the lake has been drifted on for 100 feet and the working is in ore all the way. The drift on the Victoria vein has been extended another twenty-five feet and the face is still in good ore.

Gowganda.—The machinery for the Reeves Dobie mill is already on the road, and a considerable part of it is in Elk Lake, from which point it will be teamed to the mine. It is estimated that there are 15,000 tons of milling rock in sight and that the high-grade ore will be sufficient to pay operating expenses.

The management of the Millerett has also decided to put in a small mill, although it is probable that the machinery will not be taken in until the winter roads are in shape. Development work on this property is very encouraging and at the 185-foot level the vein shows a good width of high-grade ore. Another small shipment was made a few days ago via the Montreal River.

The Gates property has also made a shipment of twenty tons of high-grade ore. After losing their vein several times, a fine ore shoot was picked up on the 140-foot level. The mine shows every promise of becoming a regular producer.

Several discoveries of minor importance, chief of which is the one on a claim owned by Otisse and Currie, near Hubert Lake, have lately been made in the vicinity of Elk Lake. At a depth of 200 feet, a small aplite vein, carrying small values in silver, came into the Devlin shaft. Before continuing the shaft on this vein, however, a cross-cut will be run to cut the veins on which the shaft was originally started. A proposition to build a customs concentrator at Elk Lake came up before the council of that town a short time ago. Unfortunately there is no available tonnage in the district with which to supply it.

Porcupine.—This district has had its first snow storm, which occurred on August 25th, and since that time there have been some heavy frosts. The snow, of course, did not last, and it will probably be two or three months yet before it comes to stay. The rains have been very heavy and have seriously interfered with outside work.

On account of the stiff competition on the Kelso route, there has been a very material reduction in freight rates, and supplies can now be brought in for $2.75 and $3.00 per hundred weight. This will mean a very considerable saving to the operators, and will probably mean that more men will be employed.

There is activity in the Township of Shaw, and undeveloped claims have recently sold there for $4,000 each. Everywhere in the district, there is a strong healthy development, and the entire absence of wild-catting is one of the significant features. The most important work is being done on the Timmins and Dome properties. The former has a small prospecting mill that treats approximately one-sixth of the ore produced daily. The returns, however, are so large that they cover the entire cost of operating the property, which employs 135 men, and also leave a comfortable surplus.

On one of the claims in Shaw Township, the owner is panning the earth above the veins and is obtaining very good results.

The owners of the Swastika property have decided to install a five-stamp mill and a small cyanide plant. A small two-stamp mill has been in operation for some time and excellent results

have been obtained even though a large part of the values were not recovered.

It has been definitely decided to erect a stamp-mill of considerable size on the Dome property if proper transportation facilities are available. The size of the mill has not yet been decided upon. Although work was carried on under great difficulties, already 900 feet of underground development has been accomplished and the results are perfectly satisfactory to the owners. A considerable amount of diamond drilling was done, and the vein was cut at a depth of 300 feet, at which point it still continued to show free gold.

BRITISH COLUMBIA.

The British Columbia Bureau of Mines has issued Bulletin No. 1, 1910, being a "Report on Certain Mineral Claims in Atlin, Bella Coola, and Nanaimo Mining Divisions," by Mr. Herbert Carmichael, provincial assayer. The claims concerning which information is given are as follows: In Atlin division, the Northern Partnership Group, formerly known as the Engineer Group; in Bella Coola division, Sure Copper Mountain group and Bella Coola Chief group; in Nanaimo division, the Great Granite mines, Great Gold group and White Swan group, all on Valdes Island, and the St. Joseph group, on Lasqueti Island. While some useful information is given concerning the several properties mentioned in the first and last above-mentioned divisions, it is not clear what good purpose is served by the inclusion in this departmental publication of the page relating to claims in Bella Coola division, the most important of which were not visited by the officials.

It is respectfully submitted that this published result of an official visit to what is supposed to be a possible mining district is of little practical use. However, the redeeming feature of this bulletin is found in the fact that the information given relative to the Engineer or Northern Partnership group is of a nature that will enable those interested in the matter to judge for themselves what warrant there was, if any, for the statements widely published a few weeks ago relative to the intention to erect on the property a 100-stamp mill. As is customary with British Columbia government publications, this report is well printed and illustrated.

Cariboo.—Information has been received of the registration in London, England, of the Lightning Creek (British Columbia) Hydraulic Mining Company, Limited, with an authorized capital of £150,000, in shares £1 par.

Rain has fallen lately, but not in sufficient quantity to allow of hydraulicking operations being resumed. It now looks as if there will not be any more hydraulic placering this season.

Attention has recently been called to the fact that the recorded production of gold from Cariboo district had, by the close of 1909, exceeded an aggregate of $40,000,000. While the value of the average annual production in quite recent years has not been much more than $300,000, there is reason to expect a considerable increase after the large new hydraulic plant for the Quesnel Forks district shall be in operation. Seven or eight years ago an official report gave an estimate of the available low-grade gold-bearing gravels in this section as being 2,500,000,000 to 3,000,000,000 cubic yards, which at ten cents per yard gives a possible $300,000,000 worth of gold awaiting recovery here.

East Kootenay.—Before control of the Crow's Nest Pass Coal Company passed to the Great Northern Railway and allied interests, it was customary for the tonnage of coal produced to be published weekly in the Toronto Globe. For more than a year, though, similar information has not been regularly obtainable, the Nelson, B.C., correspondent of the Dominion Labour Gazette, included in his report, published in August, the following statement: "The tonnage mined by the Crow's Nest Pass Coal Company, at Coal Creek and Michel, for the month of June is reported at 116,447 tons, while the payroll for the same period amounted to $203,400." That tonnage would give a daily average production of 4,479 tons of coal for 26 working days. Recently, however, the Fernie Free Press has stated the daily average production for part of August to have been more than 5,500 tons a day. If the latter be correct, it is evident that there was a substantially large increase of output in August over the average daily production for June. In the summer of 1909 announcement was made at Fernie, by the then manager, of the intention of the coal company to considerably enlarge its production of coal, but this was not done so soon as promised. Lately, however, the forecasts then made seem to have been, in some measure, realized.

Ainsworth.—The recently organized Kootenay Silver-Lead Mines, Limited, has commenced work at the Highland mine and concentrating mill. Mr. H. Shell, late of Denver, Colorado, is manager, and has about 30 men in mine and mill. Silver-lead ore and concentrate are being shipped to the Consolidated Company's smeltery at Trail.

It is stated that the Highlander mine will soon be worked again. It has been idle several years. Much underground work has been done in this mine in past years, the main tunnel having been driven more than 2,600 feet, and drifts run from it on the veins intersected. When in operation, pumping and hoisting from winzes was done by compressed air delivered from the Taylor hydraulic air compressor on Coffee Creek, about two miles south of the mine. It is stated that the first drill every driven by compressed air derived direct from falling water, under the Taylor patents, was started in operation in this camp in April, 1900. A wire tramway connects the mouth of the tunnel with the company's concentrator near Kootenay Lake. About 700 tons of lead concentrates and 100 tons of hand sorted ore have been shipped; average contents, 67 per cent. zinc lead, 4 per cent. and 22 ounces silver.

[Note.—"Highland" and "Highlander" are separate properties.]

Nelson.—The Eureka mine near Nelson, recently again made a shipment of gold-copper ore after having been for a year or two on the non-shipping list. In 1907, 620 tons of ore was shipped, this giving an average assay value of 5.5 per cent. copper, besides some gold and silver. Since then the low price of copper has militated against production being continued.

Announcement has been made that a syndicate will take over the Silver King, Dandy and other mining properties, situated on Toad Mountain, near Nelson. During the last two years, until June last, the Silver King has been worked under lease by the Kootenay Development Syndicate, an English company, under arrangement with the liquidators of the Hall Mining and Smelting Company. Altogether, since 1896, more than 200,000 tons of ore have been extracted from this mine; the approximate total metal contents of this ore were 4,500,000 ounces of silver and 14,500,000 pounds of copper. While most of the known ore above water level has been taken out of the mine, it is believed there is still a considerable quantity that could be mined from the lower levels were the mine to be kept unwatered.

Rossland.—In connection with the recently reported leasing and bonding of Cliff and Consolidated St. Elmo properties by the Granby Consolidated Mining, Smelting & Power Company, it is of interest to note that in a preliminary report on Rossland mining district, by Mr. R. W. Brock, now director of the Geological Survey, there occurs this brief reference to this property: "The well-marked vein of the St. Elmo-Cliff-Monte Christo has produced several hundred tons of ore that averaged about $20, and a considerable tonnage of low-grade ore that has an excess of iron over silica, such as is desired by some of the smelters." Some development work is being done on the Cliff under the direction of Mr. W. Yolen Williams, of Spokane, Washington, who for several years superintended the development of the Granby Company's big mines in the Boundary district.

Information received from London is to the effect that Mr. A. J. McMillan, late managing director of the Le Roi Mining

Company, who has been appointed liquidator of the company in connection with its being voluntarily wound up, will return to Rossland from England during October.

Queen Charlotte Islands.—The Vancouver syndicate which some time ago bonded the Japanese group of gold-copper claims at Ikeda Bay, Moresby Island, has made a second payment of $30,000 (the first payment was $8,000), and has arranged with the vendors to accept $150,000 in stock in the new company, and a final payment of $12,000 in cash, to make up the purchase price of $200,000. The prospecting done with the diamond drill by the syndicate under the bond is reported to have proved the occurrence of two ore-bodies not previously discovered. One of these has been reached by driving a 50-foot cross-cut. Assay returns from the ore thus opened have ranged up to much higher value than the average of that shipped when the mine was producing two or three years ago. Total production to date is about 12,000 tons, of an average value of $11 to $12 in copper, gold and silver. The plan of further development contemplates provision for putting the mine in condition to ship an average of 100 tons of ore daily. The ore will be sent to the Tyee Copper Company's smelter at Ladysmith, Vancouver Island, for treatment, a favourable freight and treatment rate having been arranged.

GENERAL MINING NEWS.

NOVA SCOTIA.

Amherst, Sept. 22.—The Maritime Coal, Railway and Power Company, whose headquarters are at Montreal, and whose chief colliery is at the Joggins mines in this county, is making steady progress in developing the extensive coal fields owned and operated by the company. Its sea-going trade is steadily increasing, as is evidenced by the shipments for the week ending September 16th. During that week the company loaded ten schooners for ports along the Bay of Fundy. The schooners were as follows: The Adella, 100 tons; Emma T. Story, 60 tons; Annie Pearl, 60 tons; Abbie Vernor, 125 tons; Helen M., 110 tons; Abbie Keith, 180 tons; Laxvan, 140 tons; all of Windsor. The Dorothy, 90 tons for Digby; The Nettle, 125 tons for Briar Island, and the E. Mayfield, 100 tons for Partridge Island.

Sydney.—The Dominion Steel Corporation are calling for tenders for the erection of seven large buildings at the steel plant here, to be constructed immediately. Additions include boiler house, machine and railway shops, foundry warehouse, oil house, carpenter shop, repair shop, and finishing mill. The buildings will be entirely of concrete and structural steel. The company is also considering the advisability of building new general offices.

ONTARIO.

Cobalt, Sept. 26.—Two bullion shipments left the camp last week, one from the O'Brien, the regular shipment to England, and the other from La Rose. The total shipments of bullion now total 447,615 ounces, valued at $232,907. The two shipments which left this week were as follows: O'Brien—30 bars, weight 30,000 ounces; value, approximately $16,000. La Rose—31 bars, weight, 28,505 ounces; value, approximately $13,695. The total of the bullion shipments for the week is therefore 61 bars, weight 58,505 ounces; value, $29,695. The La Rose bullion was consigned to the La Rose Consolidated Mines, Limited, Broadway, New York.

Collingwood, Sept. 22.—Mr. J. R. Roaf, barrister of Toronto, met the Board of Trade last night and discussed a proposal to establish extensive iron works here. The new company is at present known as the New Iron Company, Limited. It is asking the town for certain concessions.

Hamilton, Sept. 22.—Yesterday Wm. Mulliss, publicity commissioner, announced that the Canada Steel Company would locate a steel mill in this city and that work in constructing it would start at once. It will cost $400,000 and employ about 300 hands. The company was organized by Toronto and Montreal financiers.

MANITOBA.

Winnipeg, Sept. 22.—O'Grady & Anderson, brokers, announced yesterday having completed the sale of the Cardill coal property at Edmonton for $300,000, the members of the purchasing syndicate wish their names withheld.

BRITISH COLUMBIA.

Nelson.—H. Y. Anderson, of Anderson Brothers, owners of the controlling interest in the Beatrice silver-lead mine between Camborne and Ferguson, left on September 21st for Camborne, his mission being to place a crew of men at work preparing the mine for re-opening. In addition to getting things in shape, the men will sack about 600 tons of ore now on the dump, in anticipation of the rawhide season. In due course, mining operations will be resumed on a large scale.

Nelson, Sept. 21.—Interest has been aroused in the Creston district by the discovery of placer gold deposits in the bed of the Goat River. Ira Beam, an old-time prospector and gold miner, who has passed through some of the greatest gold rushes in Western America, including the stampede to Nevada, is the discoverer of these claims.

Nelson.—That the Mother Lode and Clyde-Belt mines of the Sheep Creek gold camp are continuing to push development aggressively, by new cross-cut tunnels, is the latest news from that camp. In the case of the Mother Lode, William Watson, general manager, is now driving a cross-cut tunnel from a point slightly upcreek from the recent working to come under the old workings and tap the vein. It is about at the level of No. 2 tunnel. Good headway is being made with this tunnel, and the vein ought to be reached in a short distance. The Mother Lode, like the other leading properties, is focusing its energies on development, and no ore is being shipped, as it is the intention of John McMartin, owner of the property to equip the property with a mill this coming winter. Ever since Mr. McMartin has had the Mother Lode, it has been a question of straight tunnelling to crosscut the vein at successive levels and drifting to block out ore. Less than two months ago No. 5 tunnel crosscut the main vein, on which are all the principal workings, at a depth of 380 feet.

Victoria. Sept. 21.—Mr. W. Fleet Robertson, provincial mineralogist, has just returned to the capital from the second of the field expeditions of the present season, the mineral areas of the Lillooet district being on this occasion the scene of official investigations.

The provincial mineralogist and his party went in by way of Lytton to Lillooet, and thence ascended the Fraser River to the mouth of the Bridge River, following it up the north fork from the point where a formidable canyon forbids further progress. The north fork was held almost to its source and the mountain then crossed to the headwaters of Big Creek, where some promising claims at an elevation of approximately 7,000 feet came under examination.

From this point Mr. Robertson and his party crossed another summit to Tyaxon Mountain and proceeded down Alexander Creek to Bridge River, which was followed to Cadwallader Creek, the various embryo mines of the district being visited. A crossing was next made of the summit, and the party came down to the headwaters of McGill Creek, which was followed

to Anderson Lake, all the mines of that section being taken in by the way. Thence the route lay westward to the end of Anderson Lake, where Mr. Robertson and his associates picked up the Old Caribou road, used by the inbound miners before Ashcroft and the present day connection by that point had an existence.

MINING NEWS OF THE WORLD.

UNITED STATES.

Douglas, Ariz., Sept. 16.—Construction work is now going on at both the Copper Queen and Calumet and Arizona plants. At the Calumet and Arizona the flue-dust chamber is being considerably extended to accommodate the increasing capacity of the furnaces. The furnaces at the Calumet and Arizona now consist of three 500-ton and three 300-ton. Two of the large furnaces were originally only 300-ton capacity and were enlarged. It is the intention to make all the Calumet and Arizona furnaces of 500-ton capacity by rebuilding the three smaller ones. Material for the enlargement of one of these has now been ordered and the necessary extension of the foundation and other preparations for this work are now in progress. Some time ago plans were perfected for a new stack at the Calumet and Arizona, which will be needed before the output can be materially increased. This work has not yet been started, but is likely to be in hand in the near future.

San Francisco, Cal., Sept. 17.—The statement of the dividend disbursements for August, 1910, of California oil companies listed on the San Francisco Stock Exchange, have just been compiled by Frank C. Devlin, assistant secretary of the oil securities department of the exchange. This statement shows that thirty companies paid to stockholders the sum of $1,069,917.45 during the past month.

Central City, Colo., Sept. 22.—Another concentrating plant is to be erected in Black Hawk to treat custom ore and construction has been started by the Denver Milling & Reduction Company. The capacity of the plant is to be 100 tons daily, and it is expected to be in operation within two months.

Illinois.—Since January, 1908, the stocks of crude oil in the Illinois oilfields have been gradually increasing, and now have reached the record of almost 30,000,000 barrels. Last January they were 28,400,000 barrels; in January, 1909, they were 25,000,000 barrels, and at the commencement of 1908 the stocks stood at 14,000,000 barrels. A large increase in the production of the Illinois fields is recorded owing to the bringing in of several good producers.

Washington, Sept. 16.—The Klondike placer mining district in Alaska has produced $150,000,000 in gold since 1898, and mining experts estimate the amount yet to be mined will equal that already produced. Consul Cole, of Dawson, states that the gold output for 1910 will exceed that of 1909, when more than three and one-half millions was produced. Most of this gold, he states, was shipped to the United States. A small quantity went to the new Canadian mint. Consul Cole reports that rich deposits of copper ore have been discovered in the southern part of the Klondike district.

MEXICO.

Guanajuato, Mex., Sept. 20.—Guanajuato bullion and concentrates, judging by the last report, which is about an average, are piling up a total weekly value of $28,000, of which high grades and concentrates sent to the Aguascalientes smelter run to $146,000, leaving $135,000 as the value of bullion in bars handled directly by the Guanajuato banks and sent to the Mexico City refinery. A force aggregating nearly 500 men is engaged in development at San Cayetano, Guanajuato, where the Mejiamora has been unwatered and is being retimbered.

The Mexican Eagle Petroleum Company, which owns an exclusive concession granted by the Federal Government to explore and develop for oil the lagoons and rivers along the coast, will begin work of boring wells in Lake Tamiahua. This body of water has a depth of three to four feet. It extends from a point near Tampico, south nearly to the Tuxpam River, its length being more than 75 miles and its width four to six miles. It was upon the western border of this lagoon that the great well, which was destroyed by fire, was brought in by Messrs. S. Pearson & Son, Limited, three years ago. The Tampico-Tuxpam intercoastal canal passes through this lake.

Mexico City.—The Candelaria group of mines, situated about three kilometres from the town of Ahualulco, on the San Marcos branch of the National Railways in the State of Jalisco, have been purchased by J. B. Shale for a New York syndicate from Kirby Thomas, mining engineer of New York, and E. L. Porch, of San Antonio, Texas. The price is not mentioned. The new owners also own adjoining property and are beginning development under the superintendence of W. C. Leninger, who was connected with the Amparo Mining Company. It is planned to erect a mill as soon as the old workings are well reopened.

SCOTLAND.

It is announced that further boring operations on the new shale deposits located by the Pumpherston Oil Company, Limited, in the neighbourhood of its Seafield works have confirmed earlier expectations as to the importance of the discovery. The bores have served to prove a considerable area, and there is good reason for believing that the deposits are of much wider extent. So far as proved, the bed is of good workable thickness, and the quality is that of the well-known Pumpherston shale, which is famous for its richness. Mines are being sunk on the seam as rapidly as possible, but, of course, several months must elapse before the actual raising of the shale can be begun. The new discovery will prove a valuable addition to the shale resources of the company.

FRANCE.

Paris.—The usually well-informed Moniteur Des Interests Materieles sums up briefly what European financial people have been lately saying of the proposed international copper trust. The project, which was supposed to have been definitely abandoned last spring, is to be taken up this autumn again, so the story goes now, in virtue of an understanding arrived at between the Amalgamated Copper Company, the Guggenheims and the Rio Tintos Corporation. The known presence together in Europe of the interested parties has naturally been taken as a prelude to these reports. The capital of the new combination is said to be $200,000,000, but, as this represents the value of only a single year's production in the United States alone, it is added that "special arrangements" are to be made in America to eke out this enormous but insufficient capital. One Paris financial critic announces that the news of this understanding has come out just in time to help Americans get rid of a part of their superfluous stock of copper. For the rest, it remains to be seen whether this "copper story" is or is not eventually to go the way of its predecessors.

AUSTRALIA.

Melbourne, Sept. 13.—In the Victorian Legislative Assembly to-day a motion, brought forward by Mr. Murray, the Victorian Premier and Minister of Labour, in favour of the appointment of a wages board for coal miners was carried without a division.

A deadlock, followed inevitably by a strike, is threatened in the New South Wales coal mines. The consequences will be most serious.

SOUTH AFRICA.

Johannesburg.—Despite one or two poor crushings due to exceptional conditions, the August returns from the Witwatersrand mines made a good showing, and the aggregate profits of the controlled undertakings at £967,000 represent a record for the year. The position of the companies keeping gold in reserve is also an improving one, the total of 47,634 ounces now held being the highest this year. The expansion in output has been pretty general, the outstanding features being the results obtained by the Rand mines and Gold Fields groups.

COMPANY NOTES.

The directors of the Lake Superior Corporation, in issuing their annual report for the fiscal year ending June 30th, 1910, state that the result of the year's operations of all the subsidiary companies of the Lake Superior Corporation shows a surplus, subject to depreciation and other charges, of $1,194,735.22.

The output of the steel plant, as compared with the previous year, is as follows:

	1908-9	1909-10
Pig iron, tons	130,268	153,528
Steel rails, tons	158,465	201,615

The report, by Mr. T. J. Drummond, gives the following in regard to the Helen mine:

"This company owns and operates the Helen mine. Heretofore considerable tonnage of Helen ore has been sold annually to outside firms, and considerable profit realized therefrom. Your directors, however, felt in view of the increasing requirements of the steel department that it was inadvisable 'for the present to continue the sale of this ore, which is especially suitable for our own requirements. All sales of Helen ore to outside firms have therefore been stopped, and, while this has meant a reduction in realized profits to the mining department, as also in returns to the Algoma Central Railway, we feel confident that this unsold ore lying in the mine will prove a more valuable asset than possible profits from sales meantime.

"We have also been endeavouring to ascertain, as far as possible, the extent of the ore deposits in the Helen and adjoining properties, beyond the proving and development work already completed, and in this connection the board has obtained a report from Dr. John E. Hardman, S.B,. M.E., of Montreal, which is regarded as eminently satisfactory."

The pulp mill produced 29,107 tons of ground wood pulp during the year.

With regard to new installation, the report has the following:

"As you are aware, this has been essentially a construction year. New and extensive installations are being made, especially in connection with the steel plant. We have had the usual delays and disappointments in regard to dates of completion, but the work is progressing favourably and in a workmanlike manner. We naturally have not received any results from these new installations as yet, and are not likely to obtain very much benefit before, say, the spring of 1911, but from then on the economies that will be effected in operation and the increase in output should add very materially to our net earnings.

"These new installations include a blast furnace with a rated capacity of 400 tons per day, a 12-inch and an 18-inch merchant mill, a complete installation of by-product coking ovens with sufficient capacity to care for our immediate needs in the matter of coke, a new gas blowing engine system, which will care for all our blast furnaces and create sufficient surplus power to operate the new Merchant Rolling Mills.

"Our open-hearth department will also be extended. Further provision has been made for the handling of coal and ore, etc., by additional docks and coal and ore-handling machinery of the best and most economical type. When this work is completed the directors confidently believe that, so far as the steel department is concerned, the plant will be unsurpassed in efficiency by any on the continent.

"Your directors, in pursuance of their policy of securing to the Steel Company an adequate supply of raw materials, have, during the year, added to the company's limestone properties by the purchase of the Fiborn limestone quarry in the State of Michigan, which quarry contains sufficient limestone of a high fluxing quality to last for an indefinite period.

"Your directors have also recently acquired, and are now operating the Cannelton Coal and Coke Company, which owns nearly 6.000 acres of coal lands in West Virginia."

CANADA IRON CORPORATION.

Recent reports of the year's operations of the Canada Iron Corporation were misleading in that no explanation was made of the fact that it was a period of construction with the company, and that the new plants under way were not sufficiently advanced to be productive.

The president, Mr. T. J. Drummond, in his report, pointed out, however, that the fixed charges, including interest on bonds paid and accrued to May 31st, had been cared for, leaving a surplus of undivided profits carried forward of $149,427.01.

The president also pointed out that the sales department had secured a larger volume of business than the year before, and concluded with the statement that the general showing was very gratifying in the face of the unavoidable interruption to operations that occurs during the construction period.

During the year which ended May 31st, the following work was achieved: New blast furnace at Midland, Ont.; new pipe foundry at Three Rivers, Que.; docks and terminal facilities at Port Wade, N.S.; docks and terminal facilities at Newcastle, N.B.; Northern New Brunswick and Seaboard Railway, 20 miles; developed and equipped mines at Bathurst ,N.B.; developed iron mines at Torbrook, N.S.

In addition to this, the company did considerable work on the foundry plants in Ontario, Quebec and Nova Scotia.

The company's prospects are regarded as very satisfactory, and in the current fiscal year gratifying earnings are inticipated from the new plants.

The usual semi-annual dividend of 3½ per cent. was declared on Dominion Steel preferred. It is payable October 1st to holders of September 17th.

DIVIDEND ON TRETHEWEY.

The Trethewey mine has declared a dividend of 10 per cent., being their first payment this year. Last year 25 per cent. was paid in two payments toward the end of the year. The present dividend is payable October 15th to shareholders of record September 30th.

KERR LAKE REPORT.

Kerr Lake report for fiscal year ended August 31st, shows: Total income, $1,528,983; increase, $146,693. Dividends paid, $1,050,000; increase, $550,000. Surplus, $148,220; decrease, $480,827.

STATISTICS AND RETURNS

DOMINION COAL.

The shipments of the Dominion Coal Company for the year show a very substantial increase over 1909, as is indicated by the following figures:

Shipments, 8 months, 1910	1,972,344
Shipments, 8 months, 1909	1,701,362
Increase, 1910	270,982

CONSOLIDATED FIGURES FOR AUGUST.

The Consolidated Mining & Smelting Company's statistical statement for August, 1910, is as follows:

Metals Produced.

Gold	10,194 oz.	$207,801
Silver	175,286 oz.	93,780
Copper	346,944 lbs.	43,331
Lead	2,787,301 lbs.	75,285
Total gross value		$420,197

	Per cent.
Value of gold	49.5
Value of silver	22.3
Value of copper	10.3
Value of lead	17.9
	100

COBALT ORE SHIPMENTS.

Following are the shipments from the Cobalt camp for the week ending September 17th and those from January 1st, 1910, to date:

	Ore in lbs. Sept. 17.	Ore in lbs. Since Jan. 1.
Buffalo	62,910	1,668,748
Chambers-Ferland	64,000	1,277,100
Coniagas	140,470	1,363,963
Crown Reserve	41,780	4,802,340
Hargraves	60,000	401,170
La Rose	296,040	8,489,381
McKinley-Darragh	47,700	2,893,329
Nipissing	190,040	8,683,767
O'Brien	40,000	928,410

Ore shipments for the week ending September 17th were 915,129 pounds, or 457½ tons.

Total shipments from January 1st to September 17th were 45,302,421 pounds, or 22,651 tons.

Following are the shipments from the Cobalt camp for the week ending September 24th and those from January 1st, 1910, to date:

	Sept. 24 Ore in lbs.	Since Jan. 1. Ore in lbs.
Beaver		180,617
Buffalo	53,900	1,722,648
City of Cobalt		482,875
Chambers-Ferland	64,000	1,341,100
Cobalt Central		293,286
Cobalt Lake		260,900
Cobalt Townsite	64,000	366,840
Colonial		193,480
Coniagas		1,363,966
Crown Reserve	201,820	4,994,160
Drummond		664,200
Hargraves		401,170
Hudson Bay		417,925
Kerr Lake		7,125,715
King Edward	42,110	263,406
La Rose		8,489,381
McKinley-Darragh	55,640	2,894,969
Nipissing	471,870	9,155,637
O'Brien		928,416
Peterson Lake		432,420
Provincial		65,000
Right-of-Way		1,249,237
Rochester		60,750
Silver Cliff	55,950	268,720
Standard Cobalt		194,902
Temiskaming		1,649,080
Trethewey	42,150	808,580
Waldman		63,992
Wyandoh		48,300

Ore shipments for the week ending September 24th were 1,051,440 pounds, or 525½ tons.

Total shipments from January 1st to September 24th were 46,381,672 pounds, or 23,190½ tons.

BRITISH COLUMBIA ORE SHIPMENTS.

The following are the returns of the ore production and movement for the week ended September 17th:

Boundary Shipments.

Granby	16,530	844,154
Mother Lode	8,653	246,858
Snowshoe	2,125	110,190
Nickle Plate	38	542
Jackpot	618	8,435
Rawhide	1,300	1,300
Other mines		8,834
Total	29,264	1,220,313

Rossland Shipments.

Centre Star	4,046	137,504
LeRoi No. 2, milled	300	11,100
LeRoi No. 2	200	22,934
LeRoi	176	11,396
Other mines		724
Total	4,722	183,658

Slocan-Kootenay Shipments.

St. Eugene, milled	2,775	102,675
Van Roi, milled	800	29,600
Queen, milled	420	15,540
Granite-Poorman, milled	250	9,250
Nugget, milled	110	4,070
Highland, milled	900	5,800
Wilcox, milled	75	300
Richmond-Eureka	22	3,054
Emerald	34	1,377
Sullivan	937	12,300
Ruth	36	422
Enterprise	23	44
Slocan Star	30	30
Other mines		38,124
Total	6,412	222,586

The total shipments for the week, including the estimated milling, were 40,398 tons, and for the year to date, 1,626,557 tons.

British Columbia Copper Company's Receipts.

Greenwood, B.C.

Mother Lode	8,653	246,858
Jack Pot	618	8,435
Rawhide	1,300	1,300
Other mines		8,650
Total	10,571	265,243

Granby Smelter Receipts.

Grand Forks, B.C.

Granby	16,530	844,154
Other mines	....	120
Total	16,530	844,274

Consolidated Company's Receipts.

Trail, B.C.

St. Eugene, concentrates	150	11,243
LeRoi No. 2, part concentrates	200	22,934
Queen, concentrates	39	505
Highland, concentrates	45	147
Centre Star	4,046	137,504
Le Roi	176	11,396
Snowshoe	2,125	110,190
Richmond-Eureka	22	3,054
Emerald	34	1,377
Sullivan	937	12,300
Ruth	36	422
Enterprise	23	44
Nickle Plate	38	542
Slocan Star	30	30
Other mines	....	24,247
Total	7,901	335,935

The total receipts at the smelters for the week, including concentrates, were 35,002 tons, and for the year to date, 1,445,452.

TORONTO MARKETS.

Sept. 27.—(Quotations from Canada Metal Co., Toronto.)

Spelter, 5¾ cents per lb.
Lead, 3.65 cents per lb.
Antimony, 8 to 8½ cents per lb.
Tin, 37¾ cents per lb.
Copper, casting, 13.25 cents per lb.
Electrolytic, 13.25 cents per lb.
Ingot brass, 9 to 12½ cents per lb.

Coke.

Sept. 23.—Connellsville Coke (f.o.b. ovens).

Furnace coke, prompt, $1.60 to $1.65 per ton.
Foundry coke, prompt, $2.10 to $2.25 per ton.

Sept. 23.—Tin (Straits), 35 cents.

Copper, Prime Lake, 12.62½ to 12.75 cents.
Electrolytic copper, 12.40 to 12.50 cents.
Copper wire, 14 cents.
Lead, 4.45 cents.
Spelter 5.62½ cents.
Sheet zinc (f.o.b. smelter), 7.50 cents.
Antimony, Cookson's, 8.15 cents.
Aluminium, 22 to 22.50 cents.
Nickel, 40 to 47 cents.
Platinum, ordinary, $35 per ounce.
Platinum, hard, $37 per ounce.
Bismuth, $1.95 per lb.
Quicksilver, $46 per 75-lb. flask.

SILVER PRICES.

	New York cents.	London pence.
September 8	52⅞	24⅜
" 9	53⅛	24½
" 10	53	24 7/16
" 12	52⅞	24⅜
" 13	53	24 7/16
" 14	53⅛	24½
" 15	53¼	24 9/16
" 16	53⅛	24½
" 17	53¼	24 9/16
" 19	53¼	24 9/16
" 20	53⅜	24⅝
" 21	53⅝	24¾
" 22	53½	24 11/16
" 23	53¾	24 13/16

SHARE MARKET.

(Courtesy of Warren, Gzowski & Co.)

Miscellaneous—September 27, 1910.

	Bid.	Ask.
Amalgamated Asbestos	..	15
Dominion Coal Company	..	..
Dominion Steel Company	..	..
Nova Scotia Steel	83	84
Granby	32	33
Consolidated Smelting	60	70
Crow's Nest Pass	80¼	..
Dominion Steel Corporation	64	64½

New York Curb—September 27, 1910.

British Columbia Copper	5⅝	5¾
Butte Coalition	18¼	18¾
Canadian Mines	6⅜	6⅝
Chino Copper	18⅛	18¼
Davis-Daly Copper	1 15/16	2 1/16
Ely-Consolidated	.28	.32
Giroux Mining	6⅝	6¾
Goldfield Consol.	8¾	9
Green-Canadian	6⅜	6⅝
Harcuvar Copper	none.	
Inspiration Copper	7⅞	8
Miami Copper	19¼	19½
New Baltic Copper	5½	6
Nevada Consolidated Copper	19⅝	19⅞
Ohio Copper	1⅝	1 11/16
Rawhide Coalition	.10	.11
Ray Central	2⅛	2¼
Ray Consolidated	18⅛	18⅜
Union Mines	⅞	1
Yukon Gold	3 13/16	3 15/16

Cobalt Stocks—September 27, 1910.

Amalgamated	.02¼	.04
Bailey	.07¼	.07⅜
Beaver Consolidated	.32⅜	.32½
Buffalo	1.85	2.10
Chambers-Ferland	.15¼	.15½
City of Cobalt	.23	.25
Cobalt Central	.06	.07
Cobalt Lake	.14¾	.15
Coniagas	4.50	5.00
Crown Reserve	2.81	2.88
Foster	.08	.10
Green Meehan	.02⅜	.02¾
Hargraves	.28½	.29
Hudson Bay	93.00	105.00
John Black	.01	.05
Kerr Lake	6.20	6.25
La Rose	3.89	3.94
Little Nipissing	.18⅞	.19
McKinley	.95½	.95¾
Nancy Helen	.04	.05
Nipissing	10.90	11.12½
Nova Scotia	.25	.28
Ophir	.24	.30
Otisse	.02¾	3
Peterson Lake	.21⅞	.22
Right of Way	.23¾	.24½
Rochester	.14¾	.14⅞
Silver Leaf	.07	.07¼
Silver Bar	.03½	.05½
Silver Queen	.05	.08
Temiskaming	.87¾	.88
Trethewey	1.32½	1.34
Watts	.02¾	.10
Wettlaufer	.60	.70