APRIL 1, 1917

Single Copies 15 Cents

CANADIAN MINING JOURNAL

VOL. XXXVIII TORONTO No. 7

The Canadian Mining Journal, Purman Bldg., 263-265 Adelaide St. West, Toronto, Ont.

CANADA
DEPARTMENT OF MINES

HON. E. E. PATENAUDE, Minister. R. G. McCONNELL, Deputy Minister.

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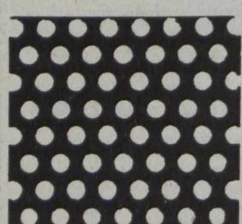

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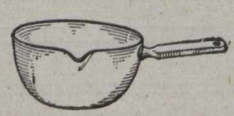

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THE CANADIAN MINING JOURNAL

VOL. XXXVIII. TORONTO, April 1st 1917. No. 7

The Canadian Mining Journal

With which is incorporated the

"CANADIAN MINING REVIEW"

Devoted to Mining, Metallurgy and Allied Industries in Canada.

Published fortnightly by the

MINES PUBLISHING CO., LIMITED

Head Office - - - 263-5 Adelaide Street, West, Toronto

Branch Office - - - - - - 600 Read Bldg., Montrea

Editor

REGINALD E. HORE

SUBSCRIPTIONS — Payable in advance, $2.00 a year of 24 numbers, including postage in Canada. In all other countries, in cluding postage, $3.00 a year.

Advertising copy should reach the Toronto Office by the 8th, for issues of the 15th of each month, and by the 23rd for the issues of the first of the following month. If proof is required, the copy should be sent so that the accepted proof will reach the Toronto Office by the above dates.

CIRCULATION

"Entered as second-class matter April 23rd, 1908, at the post office at Buffalo, N.Y., under the Act of Congress of March 3rd 1879."

CONTENTS.

INDEPENDENT REPORTS NEEDED.

The Dome Lake episode emphasizes the need of independent reports on mining properties. Shareholders who read the report of the former manager of the Dome Lake Mining Co., and assumed that it was reliable, doubtless imagined that the property was in very good shape. The new manager was unable to confirm last year's report, however, and his findings must have caused dismay among the too confident shareholders.

In the case of Dome Lake there had been persistent rumors for some months to the effect that the results of development last year were not very satisfactory. It was, therefore, somewhat of a surprise when the management announced that a large tonnage of $9 ore had been placed in sight, and that the mill was expected to be treating by November 10, 200 tons daily. The statements thus officially made were of course accepted in good faith, but the new manager's report makes it appear that they were not justified. In order to clear up the situation an independent report should be demanded by the shareholders.

As a rule shareholders of mining companies operating in Northern Ontario can keep themselves fairly well posted as to conditions at the properties. Even in the case of some important and steady producers, however, the shareholders have insufficient information for judging the value of their holdings. Independent reports by engineers employed by groups of shareholders would serve as a check on the estimates made by those in charge of the operations. In many cases there is little such special reports, and the necessary expenditure would not be justified, but in some cases at least the money would be well spent.

It is common practice for mining companies, like other companies, to have their books audited. Would it not be advisable to require that estimates of ore reserves be audited by properly qualified engineers. The ordinary auditor is dissatisfied until he has accounted for every dollar and even every cent shown on the books as expended and received, but he has an amazing disregard for the accuracy of the estimated value of the chief assets.

MISLEADING REPORTS OF EXPORTS.

The mysterious methods of our Department of Customs have been referred to before in these columns in connection with the reports on nickel exports. Nickel is, however, not the only item that is strangely dealt with.

In the list of exports of mine products in 1916 we find the following:

Gold-bearing quartz, dust, nuggets, etc, $18,382,903; silver, metallic, contained in ore concentrates, etc, $15,637,885; nickel, fine, contained in ore, matte or speiss, $8,662,179.

The Department of Customs seems to be endeavoring to conceal the actual character of our exports. Most of our gold is exported as bullion; four-fifths of our silver is exported as bullion, and nearly all of our nickel is exported in the form of matte. The Department of Customs seems to wish it to be understood that gold-bearing quartz and nickel ore are exported in large quantities. Such substances are rarely exported from Canada.

Not content with the misleading description of the character of our exports the Department of Customs continues to report ridiculous estimates of the value of the nickel matte exported. We exported copper-nickel matte in 1916 worth at least $30,000,000. The nickel content was worth at least 25 cents per lb., or over $20,000,000 for the 41,299 tons matte exported, yet the Department of Customs estimates the value at $8,662,179.

Ontario produced in 1916 nickel-copper matte containing 41,299 tons nickel and 22,430 tons copper. The nickel, when refined, would be worth about 35 cents per lb., or $28,909,300. The copper would average about 25 cents per lb., or $11,215,000. The refined products were therefore worth about $40,000,000. It is obvious then that the Department of Customs' estimate of the value of the nickel in the matte is absurdly low.

The Toronto World in its issue of March 23, printed the following:

"The annual report of the trade and commerce department for the fiscal year 1915-16, issued today, shows that the nickel export was as follows: To Great Britain, 11,610,100 lbs., valued at $1,779,801; to United States, 58,832,900 lbs., valued at $5,934,968."

We are not surprised that the World has given this item a prominent place on its front page for our contemporary has taken a leading part in attempting to inform Canadians of the facts concerning our nickel industry. On more than one occasion, however, we have had to point out that our contemporary has been misinformed. This dispatch from Ottawa is similarly misleading. In this case the World has assumed that the figures published by the Department of Trade and Commerce are reliable. This is perhaps a reasonable assumption, but is unfortunately a false one. The Department of Trade and Commerce, if we are correctly informed, does not itself collect the statistics on exports which it has given the World, but republishes the absurd statements issued by the Department of Customs. In consequence of this unfortunate practice we have spread before the Canadian public the statement that 58,832,900 lb. of nickel contained in matte shipped to the United States during the fiscal year 1915-16 is valued at $5,934,968, or less than 11 cents per pound. As a matter of fact it should be valued at, at least, 25 cents per pound. Why should we not get proper credit for our exports? Why do our Departments persist in publishing misleading figures?

MINING TAX AMENDED.

It is understood that the Ontario Mining Tax Act is to be amended, the tax on profits being raised from 3 to 5 per cent. On profits over $5,000,000 the tax is to be 6 per cent. and on over $10,000,000, 7 per cent. Allowance for depreciation is to be increased from 10 to 15 per cent. In the case of nickel companies the Act is made retroactive to January 1st, 1915.

Under the new Act the Canadian Copper Company will be required to pay its proper share of taxation and will contribute several hundred thousand dollars yearly, instead of the ridiculously small sum which it has been paying. This company will have the honor of being all alone in the 7 per cent. class.

CORRESPONDENCE.

Contributions of the Mond Company and Employees.

Editor Canadian Mining Journal:

Sir,—The action of the Mond Nickel Company, in connection with recent Government war loans, may be of interest to your readers, or be suggestive to other companies producing war materials. The company itself was reported by the daily press as having subscribed two and a half million pounds sterling to the British loan. In addition, it offered easy facilities to its employees in Great Britain and Canada to subscribe to either the British or the Canadian war loan. Any employee was permitted to invest in war bonds up to one-half his yearly earnings, the investment to be repaid to the company, without any charge for interest, in twenty-four monthly instalments of $4.00 each for each $100 bond (for the Canadian loan). Employees in this way will receive interest on the full amount subscribed, but will have two years in which to pay for the bonds. Employees may at any time within the two years notify the company if they desire to discontinue payments and have the amount already paid in by them returned in full, without any deduction for interest on the bonds already received by them. The employees of the company at the mines and smelter near Sudbury took advantage of this generous offer to the extent of more than $110,000.

Early in the war many of the company's employees in Canada organized, for systematic voluntary monthly giving to the various patriotic funds, and petitioned the company to deduct from their monthly earnings a definite percentage from each month's pay until some months after the war is ended. Committees of the men at the different centres decided on the distribution among the various patriotic funds, of the money thus raised—the company merely acting as their banker. In this way the employees have raised up to March 1st, $37,644.

One hundred per cent. of any surplus profit made by the company during the war goes to the British Treasury.

C. V. CORLESS.

Coniston, Ontario, March 22nd, 1917.

Mr. Hallet R. Robbins, for some time a member of the faculty of the State College of Washington, Pullman, Washington, in the capacity of assistant professor of mining engineering, is now on the engineering staff of the Granby Consolidated Co., at Vancouver, B.C.

PYRITES.

There are in Ontario and Quebec important pyrites mines.

The chief producing pyrites mine in Ontario is the Northern Pyrite mine at Graham station, on the G. T. P. Ry., which is shipping at the rate of 125,000 tons a year. During 1916 the mine was being equipped for increased production and consequently the output was only about one half normal. The largest producer in 1916 was therefore the Gondreau mine, operated by the Madoc Mining Company. The Gondreau is located on the Algoma Central railway, north of Sault St. Marie.

In Eastern Ontario, at Queensboro, an excellent deposit of pyrites is being worked by the Canadian Sulphur Ore Co.

Quebec has been producing pyrites in large quantities for many years. The Quebec pyrites carries considerable copper and a little gold and silver. The chief producers are the Eustis and Weedon mines. The Eustis mill was burned late in 1915 and the new mill was not in operation until late in the spring of 1916.

Mr. Edgar Rickard, assistant director of the Commission for Relief in Belgium, is to be in Toronto on April 14. Mr. Rickard was graduated from the University of California in 1895, taking post-graduate work the following year, and after serving the usual apprenticeship as assayer and surveyor in various parts of the United States, went to Tasmania in 1899 as resident manager of the Briseis Tin Mines; 1900-1901, examination work in Mexico, Alaska and U. S. A. In 1902 to 1905 he was superintendent of the Progreso Mine in Lower California, Mexico. In 1905 he became business manager of the Mining and Scientific Press, and in 1909 managing director of the Mining Magazine, London. At the opening of the war he served on the executive committee of the American committee under Mr. Hoover, looking after the American refugees in London, and was asked by Mr. Hoover to join the Commission for Relief in Belgium at its inception, October, 1914, serving as honorary secretary up to October, 1916, when he came to New York to act as assistant director.

C.S.C.E. APPOINTS A NEW SECRETARY.

Montreal, March 21.—Owing to the increased importance of the work of the Canadian Society of Civil Engineers, with headquarters in Montreal, in its relation to national affairs, it was decided at the recent annual convention to appoint a secretary who could devote all his time to the society's interests. The position was offered to, and accepted by, Mr. Fraser S. Keith of Toronto, who was editor and manager of Construction Magazine. Mr. Keith is an honor graduate of McGill Faculty of Applied Science, and spent a year at the university as senior demonstrator in electrical engineering. Mr. Keith has had a wide journalistic career, having been associated with The Canadian Machinery as editor, and later as manager, 1905-6, and the following year he was editor of The Canadian Manufacturer. Subsequently he spent a few years in British Columbia, returning to Montreal in the spring of 1915.

ONTARIO NICKEL COMMISSION'S REPORT.

The Royal Ontario Nickel Commission, appointed on 9th of September, 1915, has presented its report to the Ontario Government. The Commissioners were: Geo. T. Holloway, London, England (chairman), a leading metallurgical expert; Dr. W. G. Miller, Provincial Geologist, and McGregor Young, K.C., Toronto. Mr. Thomas W. Gibson, Deputy Minister of Mines, acted as secretary. The report proper contains over 600 pages in addition to the appendix of 219 pages giving evidence of witnesses.

The Commissioners say that in their opinion:

"(1) The nickel ore deposits of Ontario are much more extensive and offer better facilities for the production of nickel at a low cost than do those of any other country. Nickel-bearing ores occur in many parts of the world, but the great extent of the deposits in this province, their richness and uniformity in metal contents, and the success of the industry, point strongly to the conclusion that Ontario nickel has little to fear from competition.

"(2) Any of the processes now in use for refining nickel could be successfully worked in Ontario, and conditions and facilities are at least as good in this province as in any other part of Canada.

"(3) In view of the fact that practically no chemicals are required, that there is a much more complete saving of the precious metals, especially platinum and palladium, and that electric power is cheap and abundant, the most satisfactory method of refining in Ontario will be the electrolytic.

"(4) The refining of nickel in Ontario will not only benefit the nickel industry, but will promote the welfare of existing branches of the chemical and metallurgical industries, and lead to the introduction of others.

"(5) The methods employed at the Ontario plants of the two operating nickel companies are modern and efficient, although there are differences in both mining and smelting practices. It is the consistent policy of both companies to adopt all modern improvements in plant or treatment. Even during the present time of acute pressure the Canadian Copper Company has materially increased its output without substantial enlargement of its plant, and the loses in smelting are less, both at Copper Cliff and the Mond plant at Coniston, than they were a year ago. These companies have each had their experimental stage, neither has asked nor received any Government assistance, and both have earned the success which they have achieved.

"(6) The present system of mining taxation in Ontario is just and equitable and in the public interest, and is the best system for this province. Any question of change is rather one of rate than of principle.

"(7) Experiments have been undertaken by the Commission in the production of nickel-copper steel direct from Sudbury ore, and also in the electrolytic refining of nickel. Certain improvements in the latter process have been made the subject of application on behalf of the Government of Ontario for patents in Canada, the United States and Great Britain."

DEEP DRILLING AT SUDBURY.

Deep drilling of the Frood Extension property owned by the Mond Nickel Company, is to be undertaken. The hole will be put down 3,000 ft. Smith and Durkee of Sudbury will do the work.

MINERAL DEPOSITS NEAR KINGSTON, ONT.*

By M. B. Baker.

It has been frequently stated that there is probably no other area of equal size, which has produced such a variety of economic minerals as has that contiguous to Kingston, Ontario. Within fifty miles of this city there has been produced from time to time the following products: Mica, phosphate, graphite, gold, arsenic, copper, iron, lead, zinc, barite, talc, corundum, feldspar, quartz, actinolite, molybdenite, fluorite, pyrite, building bricks, lime, cement, building stone and road metal.

It is a fundamental principle of economic geology that all metalliferous as well as other constituents of rocks have been derived ultimately from the interior of the earth, have been brought to or near the surface through igneous activity, and have there suffered, as a rule, further concentration by natural processes, to become of economic value. With three periods at least, of igneous activity proven in pre-Cambrian times, namely, the Laurentian, the Algoman, and the Keweenawan, it is not surprising that these rocks should carry economic deposits of considerable variety and substantial value.

Feldspar.

Among the intrusive rocks in the Kingston area are the pegmatites of late Algoman age. These are found cutting the large main masses of Algoman granite, as well as the earlier Laurentian and Grenville series. They are very coarse grained as a rule, so much so that their chief constituents, feldspar and quartz, are mined separately in large quantities. This is only possible where these dikes cut gneisses, in which case they yield a beautiful feldspar carrying 13 per cent. of potash. These dikes have generally a pink colour and are very coarse grained. Most of this feldspar is mined about Verona and Bedford, on the Canadian Pacific railway, and is shipped from there to the United States, to be used for glazing white earthenware dishes, lavatory equipment, terra-cotta tiling, electric insulators, reflectors, etc. The quartz is shipped to the Niagara peninsula for use in the various silicon combinations, so largely manufactured there. A more recent use of the second grade of feldspar is for the extraction of its potash for the manufacture of artificial fertilizers. This industry may be considerably developed in the near future.

Where Algoman dikes cut Grenville crystalline limestones, they are no longer pink, but white or bleached, and do not show the constituents segregated into masses fit for mining; but, on the contrary, exhibit the most intimate mixture of their quartz and feldspar. Much of it is actually graphic granite, where the most pronounced intergrowth is evident. The feldspar in this case is no longer the potash-rich orthoclase and microcline, but is a pale to white oligoclase, which carries about 6 per cent. of potash and 3.5 per cent. of soda. From these facts it is clear that the Algoman pegmatites are of economic value where they cut gneisses, but are of no worth where they cut the crystalline limestones. This fact should prove instructive to prospectors in the search of additional supplies of feldspar in this and adjoining areas.

Mica and Phosphate.

Southeastern Ontario has long been known as an important producer of amber mica. In the "Geology of Canada," issued by the Geological Survey of Canada in 1863, reference is made by Sir William Logan to the occurrence of mica in this region. On page 796 is a brief statement of important mica occurrences in Ontario, and the paragraph closes with this statement: "It appears probable that by further exploration in this region, and in Grenville, sufficient quantities of mica could be obtained to supply a large demand."

All early reports of mica occurrences speak of its association with phosphate, and the phosphate industry flourished long before the mining of mica was carried on. In 1868 apatite was mined by the Rideau Mining Company in North Burgess township, and was shipped to Germany. It then brought seven dollars per ton. In 1871 apatite was discovered in the township of Loughborough by H. G. Vennor. Mica then began to be mined as a by-product in the phosphate industry. It was not, however, until after 1890 that there was any appreciable demand for mica. Of the great amount that had been mined in the phosphate industry, and thrown on the dumps, only a very small portion of the choicest sizes procured a market.

After 1890 both mica and phosphate found sale for a while, but the placing of the easily mined phosphates of the southern States on the market soon stopped the sale of the harder and more costly phosphate of southeastern Ontario. The mica industry continued to grow, however, and has been a valuable one ever since. It is not the writer's intention to deal in detail with this industry, a monograph, No. 118, having been issued by the Department of Mines, Ottawa, in 1912, which is full of information for those who wish it in detail. There are certain points, however, regarding the origin of mica and phosphate deposits that do seem worthy of note here. The detailed mapping of this area gave the writer an opportunity to study, and aid in deciding, some much debated points as to the origin of phosphate and mica deposits in pre-Cambrian rocks.

It is probably natural that the first theories of origin suggested for phosphate should be organic, and early Canadian geological literature assigns this theory. Vennor, G. M. Dawson, Fielding, Davidson, J. W. Dawson, and Harrington claimed that the phosphate deposits were derived from organic remains, originally present in the sedimentary gneisses and limestones in which they are now found. History repeats itself, and, as in all similar discussions, an exactly opposite view was soon put forth by other geologists. Quite in contrast with the organic theory was the theory that these deposits were of purely igneous origin. This theory has been supported by Selwyn, Bell, Ells, Coste, and others.

Coste sums up the matter thus: "We believe we have gathered year after year strong and clear evidence to show that not only our deposits of iron ore in Archean rocks, are of eruptive or igneous origin, but also that our deposits of phosphate are exactly similar, and have also the same origin."

Two theories more opposed in character, could not have been put forth to explain the same phenomenon, but there was considerable evidence for each, and from the study of individual deposits, it would be almost possible to prove either theory. The writer, after mapping this area geologically, saw certain relationships which show that both of these theories are partially correct, but that a combination of the two is necessary to account for the deposits satisfactorily. Certain essential ingredients were present in the sedimentary rocks as claimed by the first school; while certain other ingredients were introduced by the igneous activity, and the aqueo-igneous combination produced the results now found.

* Extracts from a report published by the Ontario Bureau of Mines.

Deposits carrying phosphate and mica are often of quite irregular shape, the so-called "pockets." As a rule they are rather vein-like in that they follow the strike of the gneisses, or the contacts of the gneisses with crystalline limestones. A few deposits do cut across the general rock structure at an angle. Generally there are no walls, or sharp contact planes, between phosphate deposits and their surrounding rocks. The beds are extremely irregular in shape, and only rarely does anything like a true vein show. The deposits are usually made up of pyroxene, phlogopite, apatite, and calcite, named in the order of their crystallization. Many of the mica deposits are free from calcite, and some are free from apatite or phosphate, but none are free from pyroxene.

This has led to the common statement that our mica and phosphate deposits are found in "pyroxenites," and these pyroxenites have been described as intrusive, plutonic masses of coarse crystalization, which have intruded the gneisses and crystalline limestone. This is what a pyroxenite should be, but not what these actually are.

The writer got his first hint as to the explanation of the origin of these deposits while examining a contact of Algoman granite with Grenville crystalline limestone on lot 5, concession VI., of township Storrington. The contact was a clean one between these two rocks. Along the contact were developed scattered crystals of pyroxene, phlogopite, apatite, calcite, scapolite, graphite, and other minerals, showing clearly that these minerals had developed as contact metamorphic crystalization, and were the result of a siliceous magma coming in contact with a dolomitic limestone country rock. The lime and magnesia acquired from the dolomite formed with the silica of the intrusive the minerals found in these so-called "pyroxenites;" the necessary amounts of alumina, iron oxides, and alkalis, being just as easily accounted for as the more abundant constituents.

In the Kingston area Laurentian granites intruded the Grenville limestone and lime-holding sediments in great amount; and these intrusions usually produced an elongated lens-like, or plate-like shape, depending upon the perfection with which they followed the structure of the pre-existing gneisses and schists of Grenville age. It is obvious therefore that the contacts would be vein-like in shape, as a result of following the gneissic structure of the country rocks. Thus the shape of the so-called "pyroxenite dikes" or mica veins is accounted for. They are simply contact metamorphic deposits produced by the intrusion of the siliceous Laurentian granite into the basic Grenville limestone, rich in lime and magnesia.

Testing this theory the writer then traced the contacts of the main Laurentian belts with the crystalline limestone, and was astonished to find how perfectly the economic deposits of mica are strung along such contacts. In many cases the contact produced a rather compact, fine-grained, crystaline rock, composed largely of pyroxene, mica and apatite, which could very easily be taken for a pyroxenite. Its position would appear to be intrusive into the Grenville limestones and gneisses, as has been so frequently claimed. At other places, more open and spacious contacts would develop the large crystals for which this class of deposits is famous. Mica crystals measuring six feet across the base have been found in the Canadian General Electric Company's mine at Sydenham. Pyroxene crystals six inches square and eighteen inches long; apatite crystals ten inches in diameter; sphene four inches in cross section; zircon half an inch to a side and an inch and a half long, and other crystals of similar dimensions, have made these deposits famous as collecting ground for mineralogists.

The bulk of the deposits are of course along the contact in vein-like bodies, but certain fractures cross the gneiss and bedding planes of the crystaline limestone, giving rise to the so-called "cross-fissures," or dikes, which cut the structure of the country rock. It is clear that the size of the crystals, and therefore the economic value of the mica deposits, depends on the openness of the ground in which the crystals grew. Great areas, therefore, of so-called "mica rock," pyroxene and phosphate, are found which yield no marketable mica, and are readily taken for basic intrusive igneous rocks. They are too dense and compact to have given opportunity for the development of large crystals and are therefore of no economic value. The writer would, therefore, advise prospectors for mica to search out contacts of crystaline limestone with Laurentian gneisses, and following along these contacts, searching for places where sufficient openings or spaces were formed to allow for the growth of large crystals. That the granite intrusion which caused the metamorphism and mineralization, was Laurentian in age, and not Algoman, is certain, because both Algoman and Keweenawan dikes cut these mica-phosphate deposits.

It has been stated in the literature, and more frequently by mica miners, that mica is "pockety," and only "superficial" in its development, and that it will "not go deep." These statements are only partly true. There is no reason to limit the depth to which mica may be found, but it is such an easily cleavable and very fissile mineral that, at depth, mica crystals are apt to slip and be wrinkled or crumpled by pressure, which renders them useless for economic purposes. Just as one often says that certain segregated ores have a commercial wall, so one can say that mica has a commercial depth. If there has been no serious pressure to deform the mica physically, there is no reason why it should not follow indefinitely down the contacts on which it has formed.

Lead and Zinc.

In the year 1870 an outcrop of galena was found on the south half of lot 16, concession IX., of Loughborough township. It was worked in a desultory fashion, by the local inhabitants for five years. Sufficient galena was shown to attract an English company, and in 1875 the Frontenac Lead Mining and Smelting Company was formed. This company sank a shaft 250 feet deep, and ran five fifty-foot levels. In five years it took out over 2,000 tons of ore, which was reported to average 12 per cent. in lead, and five ounces of silver to the ton of galena.

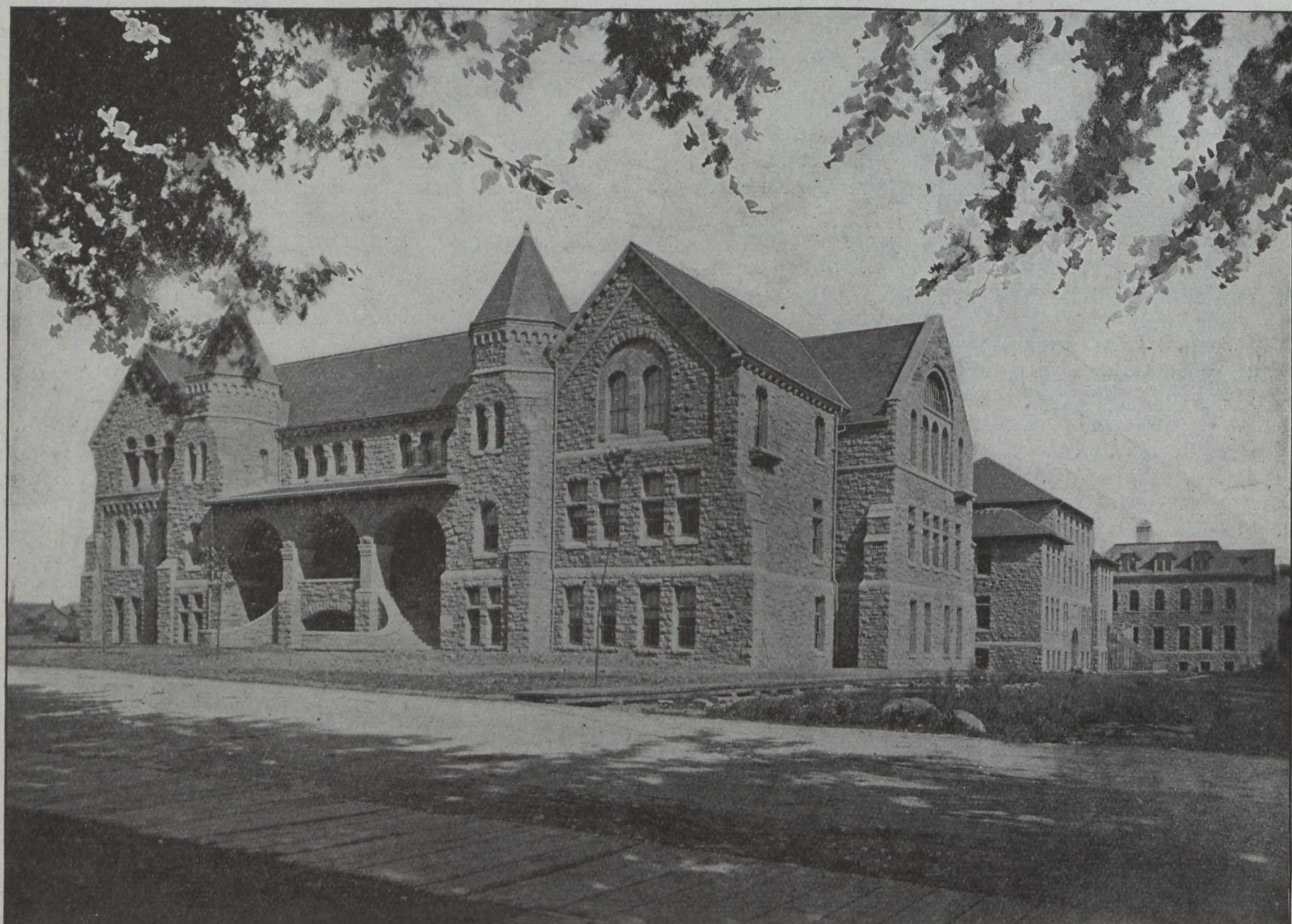
This company traced the vein to the northwest for about three-quarters of a mile, and opened up two other shafts, showing a mixed ore of galena and zinc blende. The ore at the original opening, or No. 1 shaft, was entirely galena. The vein was traced, also, to the southeast into concession VIII., a distance of nearly a mile, where the large mass of Algoman granite, shown on the map, is met with, and where the vein showed no further development. At shaft No. 1 the wall rocks are gneiss, partly Laurentian in age and partly Grenville in lit-par-lit intergrowth. This country rock extends southeast to the Algoman intrusive. Following the vein northwesterly from No. 1 shaft, it passes into a small swamp, and when it emerges at the other edge, the wall rocks are Grenville crystaline limestone. The contact between the gneiss and crystaline limestone lies in the swamp and cannot be seen, but at the southwest edge of the swamp a belt of pyroxene phosphate rock is developed, carrying mica as has just been described.

The gangue of the lead vein is coarsely crystaline calcite, which makes a very striking vein in the gneiss and crystaline limestone. It is from six to twenty feet in width, dips vertically, and shows a remarkable ribboned or banded structure with the sulphides of lead and zinc. It is evidently a typical encrustation vein.

Regarding the origin of this deposit it is evident that the opening is not the result of solution, for the vein is a distinct fissure at least one and a half miles long, and with distinct strike and dip, sharp clean-cut walls, no impregnation of the country rock by ore or gangue, and cuts at least one contact between gneiss and crystaline limestone, across their general strike. It is clearly a fracture of post-Laurentian age. Towards the southeast the vein soon meets the great Algoman batholith south of Perth Road. In other parts of southeastern Ontario north and west of this area, the Algoman has been shown to be the immediate cause of certain gold-bearing quartz bodies, and these auriferous quartz bodies often show galena as an accompanying constituent, for example, the Belmont, Deloro, Ore Chimney, Big Dipper, and other gold deposits. The Algoman granite intrusion, therefore, possibly caused the fracturing, and produced the space necessary for the orebody; while the mineralizers that accompanied the end action, or pegmatitic phase of the Algoman, could contribute the ore filling; the highly calcareous Grenville country rock would contribute the gangue of calcite.

Paving and Building Stone.

The Algoman formation around Findlay station, on the Grand Trunk railway, possesses such splendid joining that it has been quarried for building stone and the smaller blocks have been chipped to cobble-stone size and sent in car-lots to Montreal, Toronto, Ottawa and other places to be used for paving purposes. Both the granitic and syenitic phases of the Algoman have been used from this vicinity and both yield an excellent cobble stone. Larger blocks, the quality of which is excellent, have been, and are still, quarried for building purposes.



Geology and Mineralogy Building, Queen's University, Kingston, built of Black River limestone.

Building Stone.

As already mentioned, the Algoman granites and syenites around Findlay have been quarried into large blocks and shipped for building purposes. Algoman granite was also quarried at Barriefield and good red granite blocks were obtained. A solid, fresh, even-grained Algoman mass would yield good building stone in most places. Only rarely does it show any gneissic tendency, it is for the most part massive, and its remarkably good jointing makes quarrying a rather easy matter.

The Potsdam sandstones, particularly the red ferruginous sandstone, has been quarried and used for decorative stone in brick buildings, and at other times for the whole structure.

The writer suggests that the buff to white lower beds of Potsdam sandstone are so free from iron and other impurities that the refuse material from a quarry might prove very valuable as a source of glass-sand. The Potsdam exposures on the St. Lawrence waterway, on lots 28, 29 and 30, concession II., township of Pittsburgh, would be worth investigation in this respect.

Kingston has long been known as the Limestone City, owing to the fact that a large number of its homes, as well as its public buildings, are built of this rock. It is doubtful if any better building stone is to be found in Canada than the Black River beds of Kingston and vicinity. They yield a beautiful dove-blue colored stone, of very even grain and of almost any desired thickness of bed. They are remarkably free from fossils and, therefore, yield uniform, even-grained blocks. They are easily quarried almost anywhere in the vicinity and are soft and easily shaped when freshly quarried. They soon lose their quarry-sap, however, and whiten, and harden very much after exposure, giving the building a greyish-white appearance that is clean and attractive. Kingston's public buildings, churches, city hall, court house, hospital, penitentiary, Rockwood asylum, and the splendid group of Queen's University buildings, are all built of this Black River limestone. It is doubtful if any finer group of buildings for uniformity of material is to be found in the Dominion. The freedom from fossils is the chief feature of this success. For uniformity of texture and evenness of grain the writer has seen nothing to surpass the limestone of this area as a building stone. The accompanying illustration, reproduced here by courtesy of the Ontario Bureau of Mines, is of a building constructed of Black River limestone.

Building Brick.

The Pleistocene deposits of the Kingston area are not well suited to the manufacture of brick. The surface deposits are Saugeen clay; thin-bedded interlaminations of calcareous and ferruginous clay. The layers rich in lime burn to buff or so-called white brick; while the ferruginous layers burn to a rich red. The result is that the clays when dug are mixed up, and as perfect mixing is most difficult the product is spotted. The body of the brick is red, but buff spots of calcareous clay are scattered through it, in many cases spoiling the brick for any purpose except inside walls. If the clays can be thoroughly mixed together, the red ferruginous clay will mask the buff or white burning clay, and a good red brick will result.

Trap.

The Keweenawan trap dikes, of which many occur in the Kingston area, would yield the very best road metal procurable for macadam roads. Dikes on lot 18, concession IX., township of Storrington, have been quarried. As the product was mistaken for magnetic iron ore it is still on the dumps. This dike is most handily situated for mining and shipping by boat on the Rideau canal. Similar dikes occur at Washburn, also on the Rideau canal, and quite handy for water shipment. Unfortunately these dikes are of rather small dimensions, so that the supply of road metal is limited. Other larger areas of trap and basaltic rocks occur about Jones falls on the Rideau canal. These might prove of sufficient size to supply much needed road metal.

Lime.

The Grenville crystaline limestones have been much used as a source of lime. In the vicinity of Verona and Bedford, splendid kilns were erected and lime burned for shipment over the Canadian Pacific railway. The Ordovician limestones about Kingston would yield the highest quality of lime, but at present no kilns are being used on either class of rock except for purely local supplies. It would be difficult, however, to find more suitable limestone or more favorable locations for shipping than are to be had in this vicinity.

Barite.

On lot 17, concession IV., of the township of Kingston, is a barite vein that cuts the flat-lying Ordovician limestone. At this point it is from one to four feet wide. It dips vertically and strikes northwest; it is claimed it can be picked up along this strike for a distance of fourteen miles. The limestone is dense and hard with shaly partings, and its contact with the barite is very sharp and clean; there is no transition whatever from the vein into the country rock. Moreover, along the contact is a coating of anthraxolite, and some fluorite, all of which the writer takes to indicate that this vein has not filled from the surrounding country rocks, but owes its origin to an aqueo-igneous source.

Approximately one hundred tons of barite have been mined from the east end of this vein. The mineral was ground in an old burr-stone flour mill near by and shipped as a mineral pigment for paint manufacture. Nothing has been done with this vein for over twenty years.

ENLARGING PLANT AT HAMILTON.

In preparation for the prosperous times which the company anticipate will prevail after the close of the war, the Standard Underground Cable Co. of Canada, Limited, is making an addition to its factory at Hamilton, Ont., which when completed and equipped with the necessary machinery, will represent an investment of $50,000.

The new building will be devoted exclusively to the uses of the wire drawing department, and, in addition to housing the former equipment, will contain material additions of new machinery of the latest design capable of drawing wires ranging in size from No. 40 B. & S. C., which is about the thickness of a hair, to the largest size of trolley wire; also machines for grooving trolley wire and for rolling flats and squares such as are used in the manufacture of magnet wire. There will also be two new "Bright-annealing" furnaces for annealing or softening the wire after it has been drawn.

MINES BRANCH PUBLICATIONS.

Production of copper, gold, lead, nickel, silver and other metals in Canada during the calendar year 1915.

Production of cement, lime, clay products, stone and other structural materials in Canada during the calendar year 1915.

Preliminary report on the mineral production of Canada during 1916, by John McLeish.

COPPER PROPERTY OPTIONED.

The Victoria copper property near the Eustis mine, Quebec, has been optioned by C. H. Hitchcock, representing the Canadian Copper Co., of Copper Cliff, Ont. Exploration by diamond drilling is under way.

LA ROSE.

Work has been discontinued at the Maidens-Macdonald property in Deloro township, which was being explored by the La Rose Company.

UTILIZATION OF PEAT—II.

By Louis Simpson.
(Continued from March 15th issue.)

Capital Cost of Peat Manufacturing Plant; By-Product Recovery Plant; and Power Plant.

Peat, taken from a drained bog, contains approximately 85 per cent. moisture.

Peat, immediately before turning, contains approximately 65 per cent. moisture.

Peat, immediately before cubing, contains approximately 45 per cent. moisture.

Peat, 10 days after cubing, contains approximately 35 per cent. moisture.

Peat, 10 days after cubing, but harvested during hot weather, contains 25 per cent. moisture.

It seems preferable to designate these several grades of peat not by their moisture content—which, hitherto, has been the case—but by their dry fuel content:

Bog peat has approximately 15 per cent. dry fuel content.

Peat fuel, 10 days after cubing, has approximately 65 per cent. dry fuel content.

Operating Period.—In Denmark, the operations of peat harvesting, in favorable seasons, commence as early as the 6th of April. When peat is harvested for use in gas producers, excavating may be begun not only earlier, but may be continued later than when the peat harvested is intended for domestic consumption alone. When peat is to be used in by-product gas producers, the harvesting may be almost invariably commenced prior to the 10th of April, and may be continued until the end of September, or even until the end of October. Thus, 158 working days are easily available; but to be conservative, the operations of 150 days, only, are considered. Peat containing as much as 40 per cent. moisture can be used in gas producers; and since over 10 per cent. of the contained moisture may be driven out of the peat by the use of special devices, which are not costly, and which are used in connection with the bunkers which store the peat and which are located over the gas producers, it is probable that peat which, when placed in the bunkers, contains as much as 50 per cent. moisture may be used with safety.

Number of Excavators.—Two excavators, working two shifts of 10 hours each, should produce 1,160 short tons of 65 per cent. peat daily; providing they are operated as described in Part I. The production of each excavator should be, at least, 29 tons of 65 per cent. peat per hour, or 580 tons per day of two shifts of 10 hours. Working 150 days, one excavator should produce 87,000 tons. Two excavators should produce 174,000 tons of 65 per cent. peat, per season.

Labor.—The labor required per day to operate two excavator units, working double shift of 10 hours each, is as follows:

		Per day.
2 Excavators:	4 operators at $3.00 per day.....	$ 12
	4 assistants at $2.25 per day.....	9
	4 laborers at $2.00 per day.....	8
6 Spreaders:	12 operators at $2.25 per day.....	27
	12 assistants at $2.00 per day.....	24
	12 laborers at $2.00 per day.....	24
2 Tracks:	8 laborers at $2.00 per day.....	16
	—	——
Total...	56 men costing	$120

Thus, 1,160 tons of 65 per cent. peat are excavated, per day, at a cost of 10.35 cents per ton.

Turning.—Boys should be employed for this work. They should be paid by piece work, at a rate per 1,000 bricks, that will yield them (when industriously working), $1 per day of 10 hours. One boy can turn 15,000 bricks of the standard size, viz., 8 in. x 4 in. x 4 in. As intimated in Part I., it is proposed to increase the size of the bricks, making them as large as the boys can turn, without reducing the quantity so turned. The present standard size was fixed to suit the requirements of domestic trade, and not to suit the economy of manufacture. Under the proposed alteration, it is estimated that employment would be given to 33 boys, at a cost of 2.83 cents per ton.

Cubing.—Boys and young men should be employed for this work. The wages paid are based on 8,000 bricks being cubed by each operative in one day. Fifty-two boys are employed at a cost of 5.35 cents per ton.

Loading.—If loading is done into trailers drawn by specially constructed electric or gasoline tractors—the trailers being worked by specially constructed transportable loading machines, there would be employed: 8 men and 32 boys, at a cost of 4.45 cents per ton.

Transportation to Gas Producers.—This is proposed to be done by a combination consisting of specially constructed tractors, as before mentioned, drawing self-dumping trailers to certain central fixed stations, located outside the bog, and working in connection with Ambursen aerial tramways. Extra trailers would be provided, so that while one loaded set is being hauled to the central station, the other set will, in its turn, be loaded. At the central station the trailer loads are quickly dumped. The peat is then taken hold of by a mechanical loader, by which means it is loaded on to the trays of the aerial tramway, which delivers the peat into the bunkers over the gas producer, or into the receiving hopper of a breaker, which, in its turn, delivers into the aforementioned bunkers. This proposed arrangement requires the attention of 12 men, entailing a cost of 2.5 cents per ton.

Annual Preparation of the Bog.—This preparatory work is required in order to facilitate the subsequent seasons' operations, and includes the cost of turning and relocating the excavators. It is done by certain of the regular staff, after the work of harvesting is completed. It will cost less than 0.50 cents per ton.

Summary of Wage Cost in Making and Delivering Peat Fuel.

	Men.	Boys.	Cost per ton.
Excavating and spreading..	56	0	10.35 cents.
Turning................	..	33	2.85 "
Cubing................	..	52	5.35 "
Loading: using loaders.....	8	32	4.45 "
Transportation..........	12	0	2.50 "
Preparing bog..........	..	..	0.50 "
	—	—	——
Total......	76	117	26.00 cents.

Calculated upon an annual production of 174,000 short tons of 65 per cent. peat per year.

Cost of Plant.

Peat bog and lands, including drainage: 6,000 acres at $7.50........................	$ 45,000
Legal and other initial organizing expenses..	5,000
2 Improved excavators, with 3 pulpers, electric motor and track..................	30,000
6 Spreaders..........................	12,000
2 Tracks, each supplied with dump cars for 3 spreaders............................	
2 Tracks for ends of bog, and 4 removable turntables............................	
2 Motor tractors, with 16 trailers, and 4 transportable loaders....................	
4 Central stations, equipped with mechanical loaders............................	

Ambursen automatic aerial tramways	55,000
Sundries	3,000
	$150,000

Total Cost of Manufacturing Peat.

Power.—Taken from our own power plant, 150 E. H. P., for 6 months at $10 per E. H. P. year	$ 750
Taxes.—Municipal, school, and provincial	2,000
Repairs	4,000
Gasoline, lighting, oil, and sundries	5,000
*Depreciation—7½ per cent. upon $100,000	7,500
Total cost per ton on yearly output of 174,000 tons of 65 per cent. peat at 11.07 cents	$19,250
Wages cost per ton on yearly output of 174,000 tons of 65 per cent. peat at 26.00 cents	45,490
Grand total (37.07 cents per ton)	$64,740

(To be Continued).

* Note.—It is considered that the land from which the peat has been taken can be used for agricultural purposes. In that case it could be disposed of at a price equal or nearly equal to that originally paid. Hence there is no need to provide a depreciation fund with regard to the land.

BOOK REVIEW

SUBSIDENCE RESULTING FROM MINING. Young & Stoek. University of Illinois Bulletin. Bulletin No. 91. Published by the University of Illinois, Urbana. Chapman & Hall, Ltd., London, European Agents.

The University of Illinois has issued a work on "Subsidence Resulting from Mining," by L. E. Young and H. H. Stoek, which contains much valuable data on a subject that is a constant source of trouble to coal miners, especially where coal mines are worked in populated districts. The work is a result of a co-operative agreement between the Engineering Experiment Station of the University of Illinois, the Illinois State Geological Survey and the United States Bureau of Mines.

Dr. Young is the mining engineer for the Illinois Coal Mining Investigations, and Mr. Stoek is Professor of Mining at the University of Illinois, and was formerly the editor of that excellent mining periodical (now unhappily absorbed in another technical periodical) known first as the "Colliery Engineer" and later as "Mines and Minerals."

The work deals with the whole problem of coal mine subsidence very comprehensively, giving details of actual subsidence, shows the geological conditions that affect subsidence, reviews the historical theories relating to subsidence and makes some new contributions to the data on this subject. The work goes extensively into the technical details of filling the waste, both by ordinary stowing and by "flushing" or hydraulic filling. Full references to the legal aspect of subsidence are made. Not the least valuable feature of the work is the most extensive bibliography appended, which fills twenty-five closely printed pages, and seems to have been drawn from the mining literature of the whole world.

The University of Illinois has already achieved a reputation for its monographs on engineering problems, which will be added to by this latest publication.

The work contains some interesting references to sub-aqueous mining, and Canadian readers will note the references to work of this character at Wabana Mines, Newfoundland, and at the coal mines of Cape Breton Island.—F. W. G.

ADVANCES IN METHODS OF ORE TREATMENT.

During the week of February 19-24 the annual Northwest Mining Convention was held in Spokane, Washington. The season of the afternoon of February 23 was under the auspices of the Columbia Section of the American Institute of Mining Engineers, and at this Prof. Francis A. Thomson, head of the Department of Mining Engineering of the State College of Washington, Pullman, Washington, presented a paper entitled "Advances in Methods of Ore Treatment in the Last Five Years," the purpose of the author, however, having been to confine himself to non-ferrous metallurgy, and to touch only on those points of progress which he considered of surpassing importance. The following is an abstract of the paper.

Flotation Concentration.—Far exceeding all other metallurgical events in significance, actual or potential, stands the progress of froth flotation. Five years ago all of us were skeptically inclined as to the effectiveness of this method of concentration, but we were mistaken. Today the flotation process takes rank as the leading single process of ore treatment in the United States. The distribution of the quantity of ore treated as between major processes in the United States is about as under:

	Tons per Annum
Flotation concentration	30,000,000
Copper smelting	26,000,000
Gravity concentration	25,000,000
Gold and silver milling	13,000,000
Lead smelting	5,500,000
Zinc smelting	1,000,000

Probably about the same proportion will apply to the World's production, except that the proportional tonnage treated by copper smelteries will be less and that by gold mills greater than is shown in the foregoing table.

It would, perhaps, be easier to show what minerals the flotation process is not adaptable for than to enumerate all to which it is being applied, for ores of gold, silver, copper, lead, molybdenum, cinnabar, tungsten, and others are being successfully treated by it, and it is proposed to apply this process to other substances as far apart as placer gold and anthracite coal.

Electrolytic Process.—Next in significance to flotation may be placed the electrolytic process for the recovery of zinc. In this process the zinc concentrate is roasted, and then it is leached with sulphuric acid made from the roasting-furnace gases; the solution, after purification, is electrolyzed and the zinc is precipitated on aluminum sheets, from which it is stripped and melted into ingots. The zinc thus produced is of exceptional purity and commands a higher price than that produced by distillation, to the extent of a premium of two cents a pound.

Notwithstanding the protests of the furnace-zinc men, the electrolytic zinc process is successful, and it is going to make zinc distillation look to its laurels. One great advantage possessed by the electrolytic process is its suitability for the treatment of lower grade and in certain respects more complex zinc ores than is possible by the fire method. Owners of lead mines in the West have long suffered from penalties levied for the zinc content of ores they shipped to lead smelting works. If electrolytic zinc plants shall become attachments of lead smelteries, as at

Trail, B.C., then producers may hope that zinc in lead ore may become a source of profit rather than a loss by penalty.

Ore-dressing.—It is also found that momentous progress has been made in the field of ore-dressing through the development of flotation; in zinc ore treatment by leaching and electrolysis, in the leaching of copper ores, and in the improvement of copper-smelting practice.

Copper Metallurgy.—In copper metallurgy, leaching has made great strides. Naturally, flotation has checked any tendency to leach lean sulphide copper ores. It is, however, an open question whether roasting and acid-leaching of flotation concentrate may not in time seriously invade the field of the reverberatory furnace for copper recovery.

The period under review has also seen complete revolutionary change of practice in copper converting, in the substitution of basic lining of the vessels in which the metal is blown to blister copper for the siliceous material heretofore used. It is common to figure each siliceous lining as being good for 20 tons of copper, while a basic lining is found to be good for as high as 20,000 tons, which has allowed the use of larger units and decreased the time and cost of operation.

General.—In the metallurgy of gold, silver, and lead there is little of note to record. One of the largest gold mills in the world is that built near Juneau, Alaska, by the Alaska Gold Mining Co., this mill having a 1,000-ton capacity. There concentration precedes amalgamation or cyanidation of the concentrate, and the plant is doing good work.

In crushing as a preliminary to concentration, the tube-mill has found general adoption, either in the conical or the short cylindrical tpye. The advantages of the ball mill, long in use in Europe and Australia, are now recognized in America, and American metallurgists have improved on the European type.

Another field is that of by-product recovery from smeltery smoke fume and dust. Facilities for recovering sulphuric acid are now possessed at some smelting works and at many the sulphur is now being conserved.

Conclusions.—In conclusion, it is found that momentous progress has been made in the field of ore-dressing through the development of flotation, in zinc ore treatment by leaching and electrolysis, in the leaching of copper ores, and in the improvement of copper-smelting practice.

If one were venturing into the field of prophecy he would predict the growth of flotation and of hydro-metallurgy with a gradual encroachment of these two upon the realm of pyro-metallurgy.

One significant feature of the progress here reviewed is that practically all of it has occurred west of the Rocky Mountains and under the direction of American engineers and metallurgists, and as the result of sound training coupled with long experience and diligent application.

Dr. E. T. Hodge, professor of geology at the University of British Columbia, recently lectured in Vancouver on "How Mountains Have Been Formed," illustrating his address with numerous instructive lantern-slide views. Later, he took part in the proceedings of the Canadian Mining Institute at the meeting of the Western Branch.

ADDITIONS TO HOLLINGER PLANT.

Additions to plant at Hollinger Consolidated mines during 1916 cost $599,417, distributed as follows:

Buildings.	
Mill additions	$59,217
Cyanide plant	23,715
Central shaft headgear	23,465
Administration building	19,207
Directors' lodge	9,362
Transformer station	6,341
Dwellings	5,776
Central shaft plant	4,322
Fencing	1,254
Acme hoist house	1,111
Compressor plant	449
Powder magazines	386
Miscellaneous	942
Equipment.	
Central shaft plant	$183,079
Mill additions	144,642
Cyanide plant	44,456
Transformer station	44,816
Mine equipment	5,692
Acme hoisting plant	5,108
Machine shop	3,355
Office fixtures	3,289
Directors' lodge	2,606
Surface plant	2,398
Tailings, launder	2,217
Railway siding	1,445
Miscellaneous	258
Camp equipment	495

HOUSING OF UNDERGROUND CABLES.

In placing electric cables in underground conduits or in laying them on the bottom of a body of water, frequent joints are necessary. These are apt to be weak spots both electrically and mechanically unless properly made and protected. A new and improved type of joint-box or housing for use on submarine cables has recently been developed and perfected by the Standard Underground Cable Co. of Canada, Limited, and successfully used on submarine cables supplied the Halifax Electric Tramway Co. and the City of Ottawa Water Works Department.

SUDBURY PROPERTIES WORTH $100,000,000.

The Ontario Nickel Commission is not in favor of Government ownership of Sudbury nickel properties and points out that to expropriate would cost about $100,000,000.

Mr. Alex. Sharp, mining engineer for the P. Burns Co., on February 28th addressed an audience in Vancouver, B.C., on the subject of "Canada's Economic Wealth and World Power," giving prominence to the mineral resources of the Dominion.

70,000,000 TONS NICKEL ORE PROVEN.

According to the Ontario Nickel Commission proven ore reserves in the Sudbury field amount to 70,000,000 tons, while the total of proven, probable and possible ore is estimated at 150,000,000 tons.

The excellent report of the Ontario Nickel Commission has been received too late for review in this issue. We reprint a few extracts only.

CONCENTRATION OF MOLYBDENITE ORES BY FLOTATION.*

By F. W. Horton.

Molybdenite has the property, common in varying degree to most metallic sulphides, such as chalcopyrite, sphalerite, galena, pyrite, and pyrrhotite, of not being wetted readily by water, and, when dry and in small particles, of floating on a water surface. Moreover, like those sulphides, it is easily wetted by most oils. Further, in a pulp of crushed ore and water, oils have a preferential wetting action for particles of molybdenite as against particles of gangue minerals such as quartz, and this selective wetting action is decidedly increased if the water is slightly acidified. Particles of molybdenite so wetted with oil are covered with a buoyant water-repelling coating that materially assists their flotation. As the reasons for many of these phenomena—for example, the selective wetting action of oils and the increase of this selective action by acids—are not clearly understood, and as even an elementary discussion of the accepted theories of mineral flotation would be out of place here, the reader who wishes further information on the subject is referred to a clear and concise exposition by Hoover** and to an excellent paper by Mickle.† It suffices here to say that the phenomena mentioned above are the basis on which all flotation processes depend. In many processes the area of the effective surface of flotation is increased by the liberation of bubbles of gas or air in the liquid, the surface of each bubble acting in the same way as the horizontal surface of a liquid at rest. These bubbles may be of air and may be produced by violent agitation of the pulp or by release of air from solution in the liquid by a reduction of pressure, or they may be of carbonic-acid gas formed by the action of sulphuric acid on limestone or other carbonates or by other means.

Water-Flotation Processes.

Water flotation for the concentration of molybdenite depends solely on the fact that small dry particles of the mineral float readily on water, whereas the usual gangue material is easily wetted and sinks. They do not of necessity involve the use of oil, acid, or gas, and their application is extremely simple. The concentrators, which are of various types, consist essentially of a device for feeding the crushed ore in as thin a sheet and at as uniform a rate as possible onto a moving water surface in a tank and an arrangement, either by an overflow or a revolving belt of canvas or other suitable material, for discharging the floating film of concentrates into another tank. The tailings are usually drawn off from a spigot in the bottom of the first tank. In some types of apparatus the ore from the feeder is allowed to slide down an inclined plane or concave, over which a film of water is passed and from which the ore is discharged approximately in the plane of the water surface in the tank. In other apparatus the ore from the feeder falls on top of an almost submerged corrugated or canvas roller, the revolution of which carries the ore forward to the flotation surface. The object of all these devices is to place the ore on the water in a sheet only one mineral particle in depth with as little disturbance of the water surface as possible and with the majority of the particles of gangue already wetted.

Even with the best of feeding devices some particles of gangue fall on the floating film of concentrates or are otherwise mechanically entrained by it. Various methods of cleaning the film, such as allowing it to flow down an incline into a second tank, picking it up on a roller or belt and again discharging it to a flotation surface and dividing it into a large number of parts and agitating it by causing it to flow through the teeth of a comblike obstruction, are used.

No description of any particular water-flotation concentrator is attempted here, as detailed information both as to the design and the operation of a number of different types of machines is given in papers published elsewhere.

To be concentrated successfully by water flotation, a molybdenite ore should be such as to require only medium-fine crushing to liberate the molybdenite, and the gaugue should be one in which the individual particles are readily wetted. Further, if a high-grade concentrate is to be obtained the ore must be practically free from other sulphides such as pyrite, pyrrhotite, and chalcopyrite, which would be concentrated with the molybdenite. Proper treatment of the ore previous to flotation is of great importance. It should be reduced to approximately 10-mesh, or as much finer as may be necessary to liberate the mineral from the gangue, by crushing in rolls in such a manner as to make the quantity of fines as small as possible. Then if it is at all damp it should be thoroughly dried. Mechanical difficulties in the proper feeding of fine ore, and the great reduction in the capacity of the concentrators when fine material is treated exclusively, render advantageous in most instances the treating of the ore without sizing, although the capacity of the concentrators and the grade of concentrates made are considerably increased when coarse material that has been sized is treated.

The capacity of water-flotation machines varies with their type and with the character of the ore treated, and depends directly on the size to which the ore is crushed, the amount of fines made, the nature of the gangue, and the ratio of concentrates to tailings. In speaking of a particular type of concentrator, Wood says:

"A standard machine treating a 20-mesh quartz ore, using a 3-ft. width of feed and having a 4-ft. take-off belt, will vary in capacity from 1,000 to 2,000 pounds per hour, unless the ratio of concentration is low, in which case the capacity will be smaller. Some ores that possess an easily wetted gangue and call for a high concentration ratio can be fed rapidly at 20-mesh, 30-mesh, or 40-mesh. For instance, a 1 or 2 per cent. molybdenite ore in a quartz gangue will give a clean concentrate, even if the ore is fed several times faster than an ordinary sulphide ore."

The writer thinks that the capacities stated above could be had only at a sacrifice of either the recovery or the grade of concentrates obtained, and that a machine with a feed 3 ft. wide, handling 300 to 500 lb. per hour of ore crushed to pass a 20-mesh screen would be treating about the maximum quantity of material that it could separate efficiently. No figures as to cost of operation can be given, but they are presumably small as the concentrators require only moderate quantities of water and little power.

The accompanying table shows the results obtained by Wood in 10 concentration tests of five different molybdenite ores. In every test except the last, in which the ore had been slightly roasted, the recoveries were good, averaging nearly 90 per cent. In general, however, the grade of concentrates was low to medium, averaging less than 60 per cent. MoS_2. Test No. 3 is

* Extracts from Bulletin No. 111, U. S. Bureau of Mines.
** Hoover, T. J., Concentrating ores by flotation, 1912, 221 pp.
† Mickle, K. A., Flotation of minerals: Proc. Royal Soc. Victoria, vol. 23, pt. 2, 1911, pp. 555-585, abstracted by Eng. and Min. Jour. vol. 92, 1911, pp. 307-310, and vol. 94, 1912, pp. 71-76.

of special interest as it shows the results obtained by flotation of the same ore on water at different temperatures. The decided improvement in the grade of concentrates by using warm water may be attributed to the decreased surface tension of the liquid allowing some particles of gangue to sink more readily. The recovery with warm water is, however, remarkable and can be accounted for only by some factor, such as a difference in the rate of feed, that would make the tests not strictly comparable. A summary of the data obtained by Wood is given in a table which is presented below:

Results of Concentration Tests of Molybdenite Ores by Wood Flotation Process.

1	Through 40-mesh.	2.08	41.38	99.00	Colorado ore. Retreatment would materially increase the grade of concentrates with little loss.
2	Through 20-mesh.	2.00	61.55	92.27	Alaskan ore.
3	....	1.87	45.31(a) 56.70(b)	79.08(a) 89.17(b)	Canadian ore with a quartz and mcia gangue. (a) was obtained with water at 56° F. and (b) with water at 110° F.
4	Through 20-mesh.	6.66	63.50	96.34	Foreign ore.
	Through 30-mesh.	6.73	67.42	86.26	
	Through 40-mesh.	6.66	65.50	86.48	
	Through 40-mesh.	8.95	74.60	94.19	
5	Through 40-mesh.	8.65	30.00(a) 81.45(b)	79.00(a) 26.30(b)	Alaskan ore containing pyrrhotite and magnetite, and low in silica. (a) was obtained with raw ore, and (b) with slightly roasted ore.

In order to obtain data as to concentration of a molybdenite ore containing copper sulphides by this process a small-scale test was made of a sample of ore from the Whale claim, in Copper Canyon, near Copperville, Ariz. The ore consisted of a clean white quartz containing about 7 per cent. of molybdenite and 2 per cent. of copper, present largely as chalcopyrite.

After the ore has been dried and then crushed in a ball mill to pass a 40-mesh screen, it was concentrated on a laboratory-size flotation machine of the Wood type. The concentrator was so arranged that the floating film of concentrates picked up by the take-off belt was discharged to a second flotation surface from which it was allowed to run into a concentrate tank. The material that sank in the second flotation tank was considered middlings. The ore and water feeds to the machine were adjusted with the idea of causing as much chalcopyrite as possible to sink. The results of the test are given in the accompanying table.

Weight, grams	4,000.00	538.00	107.00	*3,355.00
Per cent. Molybdenite ..	†7.10+	47.44	6.74	.65
Per cent. Cu	†1.93+	5.26	5.90	1.27
Weight Molybdenite, grams	284.25	255.23	7.21	21.81
Weight Cu, grams.......	77.22	28.30	6.31	42.61
Extraction Molybdenite, per cent.	.....	89.79	2.54	.....
Extraction Cu, per cent...	.....	36.65	8.17	.....

The great difference between the percentage of recovery of molybdenite and of chalcopyrite is of particular interest. As compared with the feed, the concentrates contained approximately seven times the percentage of MoS_2 and less than three times the percentage of copper, and the recovery in the concentrates was 89.79 per cent. of the molybdenite, as compared with only 36.65 per cent. of the copper. Inasmuch as the crushed ore had stood only a short time before treatment, so that the particles of chalcopyrite had little opportunity to oxidize, which would cause them to be more readily wetted, the author considers the widely different results obtained in the concentration of the two minerals to be remarkable.

Oil-Flotation Processes.

Many of the principal processes of concentration by oil flotation are described in detail by Hoover and in numerous articles that have recently appeared in the mining press. Published data giving the results obtained by the application of these processes to molybdenite ores are extremely meager, and are practically confined to the results of treatment by the Elmore vacuum flotation system. As the Bureau of Mines at present has no equipment at its disposal for conducting tests of the various flotation processes, the concentration of molybdenite by these methods must, of necessity, be discussed here in only a general way.

Broadly speaking, oil flotation probably offers the best method of treating molybdenite ores in general, and those particular processes that have been successfully applied in concentrating ores of the other metallic sulphides would, without doubt, meet with equal success in the treatment of molybdenite. The above statement does not mean that all molybdenite ores can be successfully concentrated by oil flotation, for the physical characteristics and mineralogical composition of an ore are as important factors in determining the success of any oil-flotation process as of electrostatic or water-flotation methods. The ores best suited for treatment by oil flotation are those in which the molybdenite is flaky. From ores in which the mineral is so fine as to be almost amorphous and the gangue contains a considerable proportion of soft material, such as kaolinized feldspar, it is almost impossible to obtain a good grade of concentrates because of the flotation of some of the finer particles of gangue. Of course, if molybdenite is associated with other metallic sulphides, such as chalcopyrite, pyrite, or pyrrhotite, these are concentrated too, and must either be removed from the ore, by a preliminary treatment, or from the concentrate if a high-grade product is desired. Methods that may be employed for this purpose are discussed later. Ores containing magnetite, hematite, garnet, hornblende, or similar gangue minerals that are good conductors of electricity, and therefore are not adapted for concentration by electrostatic methods, are especially suited for treatment by flotation.

Laboratory experiments indicate that in general the particles of molybdenite that can be floated are much coarser than those of other metallic sulphides, and if finer crushing is not necessary for the liberation of the molybdenite from the gangue, material as coarse as 20-mesh may be successfully concentrated. On the other hand, there is every reason to believe that a good recovery and a fair grade of concentrates can be obtained from the treatment of molybdenite through 200 mesh because galena and sphalerite of similar fineness have been successfully treated by oil flotation. In general, therefore, oil-flotation processes are applicable to a wider range of sizes than are electrostatic or water-flotation methods, and many of them have the added advantage of large capacities from small units. For example, Hoover estimates that in one type of apparatus used in the minerals-separation process a unit consisting of six mixing boxes each only 16 inches wide and 36 inches deep will have a daily capacity of 50 to 60 tons of ore,* presumably Broken Hill lead-zinc tailings, and a 5-ft. Elmore machine will ordinarily treat from 25 to 45 tons of crude ore in 24 hours.** Capacities equal to and perhaps even greater than these

* Hoover, T. J., Concentration ores by flotation, 1912, p. 120.
** Hoover, T. J., op. cit., p. 101.

could probably be obtained in the treatment of molybdenite ores by the same units, but no definite data either as to capacities or as to costs of any oil-flotation process when applied to molybdenite ore have, to the author's knowledge, been made public. In fact, owing to the policy of secrecy adopted by most companies interested in the development of oil-flotation methods, little information is available regarding the economics of the various processes, even as more commonly applied to the concentration of the sulphides of copper, lead, and zinc. However, comprehensive data with regard to the costs of treating Broken Hill lead-zinc tailings by four well-known processes, namely, the Potter-Delprat, De Bavay, Elmore, and minerals separation, are given by Hoover. His estimates of 3s. 6d. ($0.85) per ton as the average cost of flotation and 9s. 3d. ($2.25) per ton as the average total cost of retreating these tailings on a large scale form a poor basis on which to estimate the cost of treating molybdenite ores by the same processes in small plants such as might be installed at mines producing 50 or 100 tons of ore a day. It is safe to say, however, that the costs of small-scale concentration of molybdenite ores would be considerably higher than those given above.

HOLLINGER MINING COSTS.

The following table shows the distribution of the costs of mining at the Hollinger in 1916:

Account.	Labor.	Stores.	Totals.	Milled.
General mining charges..	$10,513	$7,884	$18,397	$0.031
Superintendence	35,783	7	35,790	.059
Diamond drilling	3,024	2,234	5,259	.009
Crosscutting.............	16,458	22,426	38,884	.065
Drifting	54,997	68,303	123,300	.205
Raising	10,353	11,433	21,786	.036
Winzes...................	3,409	1,397	4,807	.008
Timbering winzes	2,322	2,154	4,476	.007
Stoping..................	230,641	259,045	489,686	.813
Scaling	12,006	3	12,009	.020
Timbering stopes and raises	38,925	19,109	57,135	.095
Re-timbering	7,170	4,751	11,922	.020
Back-filling	2,940	88	3,028	.005
Track-laying	13,722	6,854	20,576	.034
Tramming	205,074	9,901	214,975	.357
Pipefitting underground...	9,439	6,671	16,110	.027
Mine drainage	6,700	8,986	15,687	.026
Hoisting.................	34,903	16,228	51,131	.085
Landing and dumping.....	24,526	890	25,417	.042
Drill repairs	5,864	40,167	46,031	.076
Sharpening steel	29,867	11,810	41,678	.069
Distributing steel	21,623	7	21,630	.036
Mine sampling	9,959	84	10,044	.017
Change house	2,738	1,582	4,321	.007
Mine lighting	770	8,524	9,294	.015
Assaying	1,916	952	2,868	.005
Surveying	9,329	1,869	11,199	.019
	$804,083	$513,372	$1,317,455	$2.188

SUPPLIES FOR NICKEL REFINERY.

The nickel refinery at Port Colborne now under construction is expected to be in operation before the end of the year. It will consume annually 100,000 tons of materials such as bituminous coal, coke, fuel oil, nitre cake and other chemicals. The output will be at the rate of 15,000,000 lb. nickel per year.

HOLLINGER ORE RESERVES.

The following figures give a good idea of the character of the ore developed at the Hollinger. The estimate is as of December 31, 1916:

	Tons.	Value per Ton.
No. 1 Vein	325,190	$11.19
No. 2 Vein (North)	64,690	14.62
No. 2 Vein (South)	97,070	7.64
No. 3 Vein	18,000	5.10
No. 4 and 50 Veins.........	613,140	8.25
No. 5 Vein	32,540	10.00
No. 7 Vein	17,000	10.47
No. 8, 38 and 53 Veins......	637,890	7.60
No. 10 Vein	25,400	7.35
No. 13 Vein	37,000	5.54
No. 14 Vein	162,080	8.81
No. 15 Vein	65,010	10.19
No. 16 Vein	7,040	7.40
No. 26 Vein	24,860	9.33
No. 37 Vein	20,750	8.45
No. 41 Vein	317,730	7.32
No. 44 Vein	8,000	20.00
No. 51 Vein	14,600	6.36
No. 52 and 52A Veins........	86,460	10.09
No. 54 Vein	122,260	7.21
No. 55 Vein	47,570	13.13
No. 56 Vein	88,210	6.07
No. 58 Vein	276,000	8.96
No. 59 Vein	57,970	10.84
No. 65 Vein	49,300	12.47
No. 74 Vein	14,000	4.21
No. 79 Vein	17,730	5.52
No. 83 Vein	24,780	5.79
No. 84 Vein	99,120	7.01
No. 85 Vein	217,540	7.75
No. 88 Vein	2,970	14.74
No. 200 Vein	3,300	18.77
No. 204 Vein	5,920	6.40
No. 206 Vein	7,360	6.95
No. 207 Vein	42,000	6.00
No. 226 Vein	12,180	30.37
Surface....................	275,880	9.80
	3,938,540	$8.68

Commenting on these estimates, Manager Robbins says:

"In estimating the reserves we use the actual measurements of the ore in place, but when the ore is mined, it is not possible to prevent a certain amount of waste rock from being broken and becoming intermingled with the ore. This dilution with waste has the effect of lowering the value per ton of the mixture, although it increases the number of tons. Our experience, after five years of operations, has been that there is a dilution of approximately 10 per cent., and hence the present estimate of 3,938,540 tons at $8.68 per ton will when milled probably yield approximately 4,300,000 tons, averaging about $7.75 per ton."

A WAR "MOVE."

On account of Caxton House having been commandeered by the War Office, the address of the Institute of Metals will in future be 36 Victoria Street, London, S.W. The new offices are much more extensive and better suited to the purposes of a scientific society than those recently vacated.

PRELIMINARY REPORT ON THE MINERAL PRODUCTION OF CANADA DURING THE CALENDAR YEAR 1916.

By J. S. McLeish, Mines Branch, Ottawa.

(Continued from last issue.)

Gold.

The total production of gold in placer and mill bullion and in smelter production in 1916 is estimated at 926,963 fine ounces valued at $19,162,025 as compared with 918,056 fine ounces valued at $18,977,901 in 1915, an increase of $184,124, or about 1 per cent. It is the largest production since 1902. The highest production recorded was $27,908,153 in 1900, and the lowest since then was $8,382,780 in 1907.

Of the total production in 1916 $4,957,663 or 26 per cent. was derived from placer and alluvial mining; $10,472,723, or 54 per cent. in bullion and refined gold, and $3,731,639, or 20 per cent. contained in matte, blister copper, residues and ores exported.

The exports of goldbearing dust, nuggets, gold in ore, etc., in 1916 are reported by the Customs Department as $18,382,903.

Silver.

The production of silver in 1916 was 25,669,172 fine ounces valued at $16,854,635 as against 26,625,960 fine ounces valued at $13,228,842 in 1915, a decrease of 3.6 per cent. in quality, but an increase of 27 per cent. in value.

The exports of silver bullion and silver in ore, etc., as reported by the Customs Department were: 25,279,359 ounces valued at $15,637,885, as against 27,672,481 ounces valued at $13,812,038 in 1915.

The price of silver in New York which started in January with a minimum of 56¼ cents, increased quite regularly throughout the year, reaching a maximum of 76¾ cents in December. The average for the year was 65.661 cents, as against 49.684 cents in 1915.

Copper.

The production of copper has shown large increases during the past three years. In 1916 the total copper contents of smelter products credited to Canadian ores and estimated recoveries from ores exported amounted to 119,770,814 pounds which would be worth $32,580.057 at the average monthly price of refined copper in New York 27.202 cents per pound. The production in 1915 was 100,785,150 pounds, and at 17.275 cents per pound the average price for the year would be worth $17,-410,635. There was thus an increase in 1916 of 18,-985,664 pounds, or 18.8 per cent. in quantity and $15,-169,422 or 87.1 per cent. in total value.

An electrolytic copper refinery which has been installed at Trail began active operations about Nov. 1 and has a capacity of 10 tons of refined copper per day.

Of the total 1916 production 92,763,603 pounds were contained in blister copper and in matte, and 27,007,211 pounds estimated as recovered from ores exported.

The New York price of electrolytic copper increased from a minimum of 22½ cents during the first week of the year to 29¼ cents in May, falling to 22½ cents again about the middle of July. From that the price increased steadily to 33½ cents during the first half of December closing the year at about 30 cents. The average monthly price was 27.202 cents as compared with an average of 17.275 cents in 1915, an increase of 9.927 cents or 57.5 per cent. Higher prices for copper have not been recorded since 1873 when the average for the year was 28 cents.

Exports of copper according to Customs records were: copper fine in ore, matte, regulus, etc., 124,942,-400 pounds valued at $20,776,536; copper in pigs, bars, sheets, etc., 2,430,400 pounds valued at $581,268. There were also exports of old and scrap copper amounting to 5,846,600 pounds valued at $1,284,895.

The total value of the imports of copper in 1916 are recorded as $7,565,377 as against $3,957,770 in 1915. The imports in 1916 included 25,584,087 pounds of copper in pigs, ingots and manufactures valued at $7,565,377; other manufactures of copper values at $234,437 and copper sulphate $1,803,655 pounds value at $198,542. There was also a considerable import of copper contained in brass.

Lead.

Notwithstanding the demand and high prices, the actual recovery of lead as bullion and refined was less than during the previous year. The total production in 1916 of lead in bullion credited to Canadian mines and estimated as recoverable from ores exported was 41,593,680 pounds which at the average price of lead in Montreal 8.513 cents per pound, was valued at $3,540,870. In 1915 the production was 46,316,450 pounds valued at $2,593,721 (5.600 cents per pound). There was a decrease of over 10 per cent. in quantity, but an increase of over 32 per cent. in total value.

The 1916 production included 38,838,372 pounds of lead in bullion of which a large portion was electrolytically refined, and 2,755,308 pounds recoverable from ores exported. The lead bullion was produced chiefly at Trail with small contributions from smelters at Kingston and Galetta, Ont. The lead ores exported were derived from Notre Dame des Anges, Quebec, Hollandia mine, Bannockburn, Ont., Surprise Mine, Slocan, B.C., and the Silver King mine, Mayo, Yukon district.

Nickel.

The production of nickel in 1916 has as usual been derived from the ores of the Sudbury district supplemented by the recovery of a small quantity of metallic nickel, nickel oxide and other nickel salts as by-products in the treatment of ores from the silver-cobalt-nickel ores of the Cobalt district.

The total production was 82,958,564 pounds which at 35 cents per pound would have a total value of $29,-035,497. The total production in 1915 was 68,308,657 pounds showing an increase in 1916 of 14,649,907 pounds, or 21.5 per cent.

The nickel-copper ore, derived from 9 separate mines in the Sudbury district supplemented by a small tonnage of similar ores from the Alexo mine in Timiskaming, is reduced in smelters and converters at Copper Cliff and Coniston to a Bessemer matte containing from 77 to 82 per cent. of the combined metals and shipped in that form to Great Britain and the United States for refining, the product of the Canadian Copper Company going to New Jersey and that of the Mond Nickel Company to Wales. A refinery is now under construction at Port Colborne, Ont., by the International Nickel Company, in which a portion of the matte produced by the Canadian Copper Company will be refined.

Although not shipping during the year the British America Nickel Corporation, Ltd., has been actively engaged in the development of its nickel properties in the Sudbury district and in the erection of a smelter.

The total production of matte in 1916 was 80,010 tons, containing 44,859,321 pounds of copper and 82,596,862 pounds of nickel. The tonnage of ore smelted (part being previously roasted was 1,521,689 tons. The production in 1915 was 67,703 tons of matte containing 39,216,165 pounds of copper and 68,077,823 pounds of nickel.

Nickel was recovered as a by-product in smelters at Deloro, Thorold and Welland, from the silver-cobalt-nickel ores of the Cobalt district, the total nickel contents of nickel oxide, nickel sulphate and metallic nickel produced being 361,701 pounds. The products recovered included 79,360 pounds of metallic nickel; 323,418 pounds of nickel oxide and 232,450 pounds of nickel sulphate having a total reported value of $132,-896. The recovery from these ores in 1914 was 231,634 pounds of nickel.

The exports of nickel in ore matte or other form are reported by the Customs Department as 80,441,700 pounds valued at $8,622,179 or an average of 10.77 cents per pound of which about 83 per cent. were exported to the United States.

The imports of nickel into the United States during 1916 which included small quantities from other sources as well as from Canada are recorded as 72,611,492 pounds contained in ore, matte, or other form valued at $9,889,122 or an average of 13.62 cents per pound. The exports of nickel and nickel oxide, were 33,404,011 pounds valued at $12,952,493 or an average of 38.775 cents per pound of which about 50 per cent. was consigned to Great Britain and 40 per cent. to France, Italy and Russia in Europe. The United Kingdom, it will be observed, has continued to receive through United States refineries a much larger quantity of nickel than is exported directly from Canada to Great Britain. The published records do not show the details "To other countries" for 1916 but a large portion of the 2,906,665 pounds thus exported went to Russia in Asia with smaller quantities to Norway, Sweden and Spain, etc. The value of the exports in 1916 ranged from 37.128 cents to 45.211 cents per pound. The average values of the exports in 1915 to different countries ranged from 35.925 cents to 43.188 cents per pound, the total average being 38.338 cents per pound. The total average value in 1914 was 34.265 cents with a range of from 32.6 to 38.8 cents per pound.

The following table shows the production of nickel by smelters in the Sudbury districts, the exports from Canada and the United States records of imports and exports.

Zinc.

With the exception of a small production in experimental work, there was no recovery of zinc spelter, or refined zinc in Canada previous to 1916. Hitherto the production of zinc has been recorded in terms of the tonnage of ore shipped and metal contents thereof. The establishment of an electrolytic refinery at Trail, and of zinc recovery plant at Shawinigan Falls, has placed the metallurgy of this metal in Canada on a similar basis to that of lead and copper and it will be in order to record the production accordingly.

In 1916 the total zinc ore shipments from mines including the zinc-lead ores from the Sullivan mine, and ores exported were about 80,965 tons, containing 47,243,575 pounds of zinc (partially estimated in the absence of complete returns). A portion of the ores shipped to Trail were not treated during the year and the percentage of zinc recovered at the Trail refinery in the early stages of operation was probably not as large as will be secured when primary difficulties have been eliminated. Adding to the actual recovery of refined zinc at Trail 80 per cent. of the zinc contents of ores sent to the United States smelters, we have a zinc production of 23,515,030 pounds, which at the average price of zinc for the year 12.804 cents would be worth $3,010,864. Of the total production thus recorded, 1,774,080 pounds is credited to the Notre Dame des Anges ores in Quebec, and 21,740,950 pounds to British Columbia.

Production of Nickel in Canada.	1912. Tons.*	1913. Tons.*	1914. Tons.*	1915. Tons.*	1916. Tons.*
Ore mined	737,584	784,697	1,000,364	1,364,048	1,566,333
Ore smelted	725,065	823,403	947,053	1,272,283	1,521,689
Bessemer matte produced	41,925	47,150	46,396	67,703	80,010
Copper content of matte	11,116	12,938	14,448	19,608	22,450
Nickel content of matte	22,421	24,838	22,759	34,039	41,298
Spot value of matte	$6,303,102	$7,076,945	$7,189,031	$10,352,344	....

Exports of Nickel from Canada.	1912. Lbs.	1913. Lbs.	1914. Lbs.	1915. Lbs.	1916. Lbs.
Nickel contained in matte, etc.—					
Exported to Great Britain	5,072,867	5,164,512	10,291,979	13,748,000	11,136,900
Exported to United States	39,148,993	44,224,119	36,015,642	52,662,400	69,304,800
Exported to Other Countries	....	70,386	220,706	....	....
	44,221,860	49,459,017	46,538,327	66,410,400	80,441,700

Imports of Nickel into United States.	1912.	1913.	1914.	1915.	1916.
Gross tons of ore and matte	33,101	37,623	29,564	45,798	59,741
Nickel contents ... Lbs.	42,168,769	47,194,101	35,006,700	56,352,582	72,611,492

Exports of Nickel from United States.		1912.	1913.	1914.	1915.	1916.
To France	Lbs.	5,083,947	3,631,858	3,457,157	3,018,354	2,823,132
To Italy	"	....	....	....	....	2,715,521
To Netherlands	"	7,387,447	6,622,811	855,168	129,557	516,331
To Russia in Europe	"	....	....	....	....	7,767,875
To United Kingdom	"	8,191,364	8,221,640	10,836,369	14,801,565	16,674,487
To Other Countries	"	5,152,258	10,096,779	12,446,458	8,469,074	2,906,665
Total	"	25,815,016	29,173,088	27,595,152	26,418,550	33,404,011

* In tons of 2,000 lbs.

Cobalt.

Cobalt is being recovered at the smelters at Deloro, Thorold and Welland, Ontario, in the form of metallic cobalt, cobalt oxide, cobalt sulphate and other salts and also stellite the cobalt alloy used for high speed tool metal, from silver-cobalt-nickel ores of the Cobalt district. Some cobalt residues from the Nipissing mill have also been shipped to Great Britain.

The total production of cobalt contained in smelter products recovered and in cobalt residues exported during 1916 is estimated at 841,859 pounds valued at $926,045. In 1915 the production was equivalent to 504,212 pounds of cobalt valued at $536,268.

The 1916 production included 215,215 pounds of metallic cobalt; 670,760 pounds of cobalt oxide together with smaller quantities of cobalt sulphate, cobalt carbonate, cobalt hydroxide, unseparated oxides, stellite and cobalt residues.

Molybdenum.

The demand for molybdenite has resulted in considerable exploration of known occurrences and the development of several properties of considerable promise. Shipments were made during 1916 from at least 17 different localities in Quebec, Ontario and British Columbia, of which that at Quyon operated by the Canadian Wood Molybdenite Company is probably the most important. Most of the ores produced were shipped for concentration to the International Molybdenum Company's mill at Renfrew, or the concentrating plant operated by the Mines Department at Ottawa. Some ores were also shipped by the Canadian Wood Molybdenite Company for concentration in Denver, this company has also built a mill near the mine at Quyon and a second mill at Hull, Que. A concentrating mill has also been built by the Renfrew Molybdenum Mines Company at Mt. St. Patrick.

The total MoS_2 contents of concentrates produced and shipped during the year was about 159,000 pounds for which approximately $1.00 per pound has been paid the official price being 105 shillings per unit of MoS_2 at Liverpool.

A portion of the concentrates have been used in the manufacture of molybdic acid, and ferro-molybdenum at Orillia, Ont. Ferro-molybdenum is also now being made at Belleville, Ont. The Imperial Munitions Board, Ottawa, is an agent for the purchase in Canada of molybdenum for the British Government.

Iron Ore.

Mining operations have been confined to the Helen and Magpie mines of the Algoma Steel Corporation in the Michipicoten district of Ontario, together with a small production of ilmenite at Ivry-on-the-Lake, Quebec by the Manitou Iron Mining Company. There was also a shipment of concentrates from the concentrator at Trenton, Ont., produced in previous years from ores derived from the Bessemer and Childs mines in Hastings county.

Shipments of iron ore from Wabana mines, Newfoundland, in 1916 by the two Canadian companies operating there were 1,012,060 short tons, all of which was shipped to Cape Breton.

Asbestos.

The Asbestos industry has been particularly active during 1916, the value of the production having been the highest on record though the quantity was slightly exceeded in 1913. Stocks on hand at the end of the year were reduced to a minimum. Production, as usual, has been confined to the asbestos district of Black Lake, Thetford, Robertsonville, Danville, and East Broughton, in the Eastern Townships, Province of Quebec.

Chromite.

The total shipments of crude chromite ores in 1916 were 27,030 tons, valued at $299,753. These ores contained a total of approximately 6,574 tons of Cr_2O_3 or an average of about 24 per cent. A considerable portion of the low grade ore and sand, however, amounting to 14,242 tons, was sent to concentrating mills for concentration before being marketed. The quantity thus concentrated was 10,992 tons from which were recovered 1,046 tons of concentrates, averaging from 42 per cent. to over 50 per cent. of Cr_2O_3. The final shipment of ore and concentrates would approximate 13,834 tons.

The exports of chromite are reported by the Customs Department as 12,633 tons, valued at $152,534.

Production in 1915 was reported as 12,341 tons, valued at $179,540, with exports of 7,290, valued at $81,838.

Practically the entire production has been obtained in the district tributary to Thetford and Black Lake; in the Eastern Townships, Quebec.

Feldspar.

Feldspar was derived from the same districts as in previous years, viz.: Frontenac County, Ontario, and Hull and Villeneuve townships, Quebec. Shipments in 1916, which were the highest recorded amounted to a total of 19,166 tons, valued at $71,357, or an average of $3.72 per ton, and included 14,878 tons, valued at $53,332 from Ontario and 4,288 tons, valued at $18,025 from Quebec.

Fluorspar.

Shipments of fluorspar were made from Madoc, Ontario, during 1916 amounting to 1,284 tons, valued at $10,238. This was practically the first commercial operation of these deposits.

Imports of fluorspar are not shown separately in the Customs records but there is an annual consumption in steel furnaces of from 10,000 to 15,000 tons.

Graphite.

The total shipments of milled and refined graphite were 3,971 tons, valued at $285,362, or an average of $71.86 per ton, and included 495 tons, valued at $35,776 from Quebec, and 3,476 tons, valued at $249,586 from Ontario.

The production includes material varying in value from $54 to $270 per ton.

The production in 1915 was 2,635 tons, valued at $124,223.

Gypsum.

The total quantity of gypsum rock quarried in 1916, was 422,741 tons, of which 92,864 tons were calcined. The shipments of gypsum of all grades totalled 341,618 tons, valued at $730,831, and included lump, 249,759 tons, crushed 15,680 tons, fine ground 6,057 tons, and calcined 70,122 tons.

Magnesite.

Magnesite was quarried and shipped chiefly from Grenville township, Argenteuil county, Quebec, supplemented by several hundred tons from Atlin district in British Columbia.

The total shipments in 1916 were 55,413 tons, valued at $563,829, or an average of $10.17 per ton.

Natural Gas

The total production of natural gas according to returns received, was 25,238,568 thousand cubic feet, valued at $3,924,632, as compared with a production in 1915 of 20,124,162 thousand cubic feet, valued at $3,706,035. The production by provinces was as follows: Ontario 17,838,318 thousand cubic feet, valued at $2,730,653; New Brunswick 610,118 thousand cubic feet, valued at $79,628, and Alberta 6,818,131 thousand cubic feet, valued at $1,114,351.

Petroleum.

There has been comparatively little change in the production of petroleum during the past three years, although since 1907 there has been a distinct falling off. A bounty of 1½ cents per gallon is paid on the marketed production of crude oil from Canadian oil fields through the Department of Trade and Commerce. From the bounty statistics it appears that the 1916 production in Ontario and New Brunswick was 198,123 barrels on which bounties amounting to $104,014.13 were paid. The market value of the crude oil at $1.97 11-12 per barrel amounted to $392,284. In Alberta there was a small production of crude oil, but no bounty was paid on this as the specific gravity was below the standard set by the Petroleum Bounty Act and complete records have not as yet been received from the producers.

Pyrites.

The production of pyrites in 1916 was 309,411 tons, valued at $1,084,019 and included 130,799 tons, valued at $523,196 from Quebec, 177,552 tons, valued at $555,523 from Ontario, and 1,060 tons, valued at $5,300 from British Columbia. In 1915 the total production was 286,038 tons, valued at $985,190, which included 142,735 tons, valued at $570,940 from Quebec, and 143,303 tons, valued at $414,250 from Ontario.

Salt.

The Canadian salt production is obtained from southern Ontario. The total sales in 1916 were 124,033 tons, valued at $668,627 (exclusive of the cost of packages). The 1915 sales were 119,900 tons, valued at $600,226.

In addition to the production of salt, brine is pumped for use in chemical works at Sandwich, Ontario, where caustic soda and bleaching powder are manufactured by the Canadian Salt Co.

GEOLOGY OF KINGSTON AND VICINITY.

The Ontario Bureau of Mines has published a report by M. B. Baker, on the geology of Kingston and vicinity. A section of the report dealing with the Paleozoic strata was prepared by E. M. Kindle. A synopsis of the common fossils of the Kingston area, prepared by Alice E. Wilson and Kirtley F. Mather, is appended.

The report will be especially interesting to students of geology. The area covered has produced a great variety of minerals. Feldspar and mica are the minerals of chief economic importance.

EXPLORATION IN SUDBURY DISTRICT.

Exploration of nickel-copper properties in the Sudbury district will be carried on vigorously this year. Diamond drilling campaigns now under way and planned will keep several drills busy this year.

CANADIAN MINING INSTITUTE—Western Branch.

The twenty-fourth general meeting of the Western Branch of the Canadian Mining Institute was held in Vancouver, British Columbia, on March 15 and 16. In the unavoidable absence of the chairman of the branch for the current year, Mr. Bruce White, manager for the Noonday Mines, Ltd., Sandon, Slocan, B.C., the chair was filled by Mr. Robert R. Hedley, M. E., of Vancouver, who, the branch secretary (Mr. E. Jacobs, of Victoria) informed the meeting, is one of the oldest members of the Institute resident in British Columbia, his membership dating from 1898.

Afternoon Session.

There was a comparatively large and influential attendance at the opening session, held in the Vancouver Board of Trade's hall on Thursday afternoon, March 15, there having been fully 100 present, including several ladies.

On behalf of the city of Vancouver, and in Mayor McBeath's absence, Alderman Kirk spoke briefly in welcoming the members of the institute to the city. He said that British Columbia's mineral output had increased from $29,500,000 in 1914 to $43,000,000 in 1916, and would undoubtedly continue to increase at a rapid rate.

President Greer of the Vancouver Board of Trade welcomed the members of the Institute to the city, and stated that the interests of the two bodies were the same, the general development of the interests of British Columbia. "We have a special mining committee," said Mr. Greer, "and we have also what is known as a Chamber of Mines. You may rest assured that you will have the continued co-operation of the Vancouver Board of Trade. We look to you for advice and assistance, knowing that your findings go a long way toward the development of mining in this province."

The chairman briefly acknowledged the courtesy and kindness of the representatives of the city and Board of Trade, respectively, and reciprocated their good wishes.

Cottrell Process of Dust Precipitation.

Professor J. G. Davidson, of the University of British Columbia, having been invited by the chairman to address the meeting, spoke briefly concerning the Cottrell process of electric precipitation of smelter dust and fumes. He told how, by modern methods, the value which formerly was lost in the form of dust and gases, can now be saved, and that this value in many cases amounts to eight or nine per cent. of the ore recovery. The greatest development in the larger smelters has been in providing facilities for such recovery and he cited what has been done in the great smelters of the United States. He also explained the process of treating mercury ores the metal of which is the most volatile of any known metal, and until recently considered the hardest to control. By modern methods of precipitation, nearly an absolute recovery of the quick-silver content of ores can be made.

"Notes on an Iron and Steel Industry."

Mr. R. R. Hedley spoke on the iron and steel industry. In this connection he said that practically there is no such industry in British Columbia, since the firms which are engaged in manufacturing iron and steel articles depend almost exclusively on scrap iron for their supply.

It has been stated that coal in British Columbia is too costly to be converted into coke; that there are no hematite iron ores available; that labor cannot be obtained; that power is not to be had. All of these statements are rank pessimism.

As to a market for the product, provided it were produced, this is small at present, but can be extended when industries are established. Following the cessation of the war, there will be for a time a shortage of tonnage to handle all products; but Australia, Japan and New Zealand are building ships, England has never ceased, and now British Columbia is getting into the game. One year after the close of the war, he predicted that there will be plenty of ships on the Pacific to take British Columbia iron wherever it is needed. In the meantime the province should prepare for the vast wave of opportunity which is even now forming.

As to the coke situation he firmly believed that there are certain seams of coal in the Vancouver Island series which will produce a superior quality of metallurgical coke. For this purpose the fine coal is used, and coke can be made at a cost not to exceed $6 per ton, and if the by-products of the coal are saved, this cost can be cut down by $2 or $2.50.

Undoubtedly, local conditions as to labor are adverse, but by judicious management and using efficiency in all departments, this handicap can be overcome.

On the coast the ores are principally magnetite, the hematite ores occurring in the interior. Magnetite is not considered by many to be a desirable iron ore, although it is used successfully in Norway and Sweden. Mixed with hematite on an equal basis, it is easily treated, and processes are now being perfected whereby it may become the most valuable of the iron ores. The sulphur contents may not be a detriment as in the past.

There are many known deposits of magnetite ore along the coast which are very high in their iron contents, and low in both sulphur and phosphorus. It is easy in British Columbia to obtain ores which run 60 per cent. iron, and which contain as well other values. He shipped, three years from Tassoo harbor, 1,100 pounds of magnetite ore to the Tacoma smelter which carried 62 per cent. iron, 1.8 per cent. copper, $40 gold, and .4 of an ounce in silver. A little copper in the iron is not a detriment.

He was satisfied that there are large bodies of both magnetite and hematite ores in the province available, as well as lime, and coal for coking purposes.

So far as blast furnaces are concerned, their success will depend on the cheapness of available power, but there is a plethora of water power in this province which has not been developed.

He figured that it costs more in Pittsburg, where efficiency has been brought down to the "nth" stage, to produce a ton of pig iron than it would cost in British Columbia today if a plant were started.

Manufacture of Pig Iron.

Following Mr. Hedley's address, an interesting paper, contributed by Mr. M. W. Garman, of Nanaimo, was read. The two papers were discussed together, those taking part being Messrs. Nicol Thompson, E. A. Haggen, R. C. Campbell-Johnson, Professor Davidson, and others. Professor Davidson dealt with the question of producing coking coal and charcoal and in connection with the matter of government assistance to help the mining industry, he stated that representations should be made that would have the effect of placing the industry on a paying basis and he was certain that that assistance would be given.

New Pulmotor Explained.

Mr. H. H. Sanderson, mine safety engineer, of Seattle, Wash., demonstrated the use of the new "B" type pulmotor which weighs only 12½ pounds, and the operation of which is entirely in the hands of the man who stands at the victim's face, giving greater efficiency than can be obtained by the old style machines, which weigh 58 pounds. The new device is simple in operation, and can be carried on the run by anyone who is in a hurry to arrive at the scene of an accident. Incidentally he mentioned that a pulmotor was recently used in Fernie with success upon a man who had been overcome with ammonia fumes.

Short Course in Mining.

At the request of the chairman, a statement was made by Prof. J. M. Turnbull of the British Columbia University, regarding the number of students who had attended the lectures on mineralogy that had been given during the winter. They had on their roll at the lectures twenty-eight students and it was their intention to extend that series and to have the lectures given in various centres throughout the province.

Five Years' Progress in Metallurgy.

The secretary read a paper on "Five Years' Progress in Metallurgy," prepared by Prof. F. A. Thomson, head of the department of mining engineering at the State College of Washington, Pullman, Washington, which was prepared for the Northwest Mining Convention, held in Spokane, Washington, in February. In this Professor Thomson dealt with flotation concentration, methods of ore treatment, electrolytic process, ore dressing and copper metallurgy, which he concluded with a general resume of the advance in the methods of ore treatment in the last five years.

In summarizing, he stated: "It has been found that momentous progress has been made in the field of ore dressing through the development of flotation in zinc ore treatment by leaching and electrolysis, in the leaching of copper ores and in the improvement of copper smelting practice. The significant feature of the progress is that practically all has occurred west of the Rocky Mountains and under the direction of American and Canadian engineers and metallurgists."

Before adjournment until evening, the secretary mentioned the recent death of the late Mr. Wm. Blackmore, of Victoria, a charter member of the Institute. He also asked for a resolution of remembrance to be sent to members of the Institute on active service, among whom there were about thirty members of the Western Branch. The following resolution was afterward prepared by Messrs. C. A. Cartwright and A. G. Langley, and unanimously adopted:

"That those present at this meeting send cordial greeting to, and express their deep appreciation of, the splendid services of those members of the Canadian Mining Institute who are now serving their country and her allies. May they be spared to participate in a glorious peace with victory, and that at an early date."

Thursday Evening Session.

There was also a large attendance at the evening session, which was opened by Mr. Geo. Ritchie, of the Taylor Engineering Co., giving a description of a cement gun, emphasizing its effectiveness for certain work underground in mines, especially in coal mines.

Dr. E. T. Hodge, professor of geology and mining at the University of British Columbia, gave an address. in which he dealt with the future of the iron industry in British Columbia, and urging the need for a fuller determination of the extent of the iron-ore resources of the province before the expenditure of much capital on iron smelting and auxiliary works.

Technical Education in the High Schools.

Mr. John Kyle, provincial organizer of technical education, spoke on "The Necessity of Technical Education in the High Schools in the Mining Districts." He drew attention to the fact that many boys and girls left school in the intermediate grade and became what he described as vocational hoboes. The purpose of the technical schools was to fit them for work in after-life, for the vocation that they would take up. He deprecated the practice of having the same curriculum in urban and rural districts, and said that unless theory and practice were brought into juxta-position all the teaching would be in vain.

Dealing with the work that had already been done along these lines a number of views were shown giving a clear idea of the advance that has already been made in the technical education movement in this province. He urged the men to take a deeper interest in the work of the different school boards to become acquainted with what the boys and girls were learning every day, and mentioned that the government was willing to give dollar for dollar for technical equipment and 75 per cent. of the value of manual training equipment to teach boys how to work with their hands.

Progress of Copper Mining Industry.

A number of lantern slides were shown, to illustrate the progress that had been made in copper mining and metallurgy in the Coast district of British Columbia. These comprised views of the Granby Consolidated Co.'s Hidden Creek mine, and its big smelting works at Anyox, on Observatory inlet, and of the Britannia Co.'s mine and concentrating mills, near Howe sound, Vancouver mining division. The secretary gave brief particulars of the various scenes depicted.

First-Aid and Mine-Rescue Views.

In the unavoidable absence of the Chief Inspector of Mines, Mr. Thos. Graham, and of his assistant, Mr. Dudley Michel, the subjects of First-Aid and Mine-Rescue work had to be passed without the intended notice of them. The secretary gave information relative to numerous lantern-slide views of First-Aid and Mine-Rescue contests at coal and metal mines in the province, teams of competitors, training stations, ambulance cars, etc., and also showed several pictures of the U. S. Bureau of Mines' Mine-Rescue motor truck recently added to the equipment of the Mine-Rescue station on the campus of the University of Washington, Seattle, Washington.

Tacoma Smelting Works.

A lengthy and most interesting account of the smelting works at Tacoma, Puget Sound, Washington, to which reduction works has for years been shipped much of the copper ore produced in the Coast district of British Columbia, southern Yukon, and Alaska, was given by Mr. Dale W. Pitt of the company's staff. This was especially welcomed, since little information relative to the Tacoma smelting works had previously been made public in British Columbia.

Friday Evening Session.

As it had not been practicable to complete the program on Thursday evening, another session was held on Friday evening, and at this there was also a good attendance.

Two papers were read by the secretary. One was by Mr. W. M. Brewer on "Lode-Mining on Vancouver Island," and the other by Mr. John D. Galloway, assistant mineralogist for British Columbia, on "Notes on the Copper Deposits of the Northern Interior of British Columbia." These were discussed, and the consideration of the papers on an iron industry was resumed.

PERSONAL AND GENERAL

Mr. H. H. Howard, formerly on the staff of the Mining Corporation of Canada, has been appointed engineer for Colosus Gold Mines, Ltd., which company has been recently formed to develop property in Munro township, near the Croesus mine.

Smith and Durkee, of Sudbury, are resuming drilling at the Flin Flon properties, Manitoba, for Mr. Jack Hammel and associates.

Mussens, Ltd., of Montreal, have removed from 318 St. James Street, and are now occupying their new offices on the second floor of the McGill Building, 211 McGill Street, Montreal.

Mr. M. B. Myers, formerly assistant to the vice-president of the American Manganese Steel Co., has been appointed to the office of sales manager.

Mr. W. J. Elmendorf, for several years operating in Portland Canal mining division of British Columbia, but now having his headquarters in Seattle, Washington, has been examining mining property on the West Coast of Vancouver Island.

Mr. C. F. Caldwell, of Kaslo, B.C., who for some time past has been actively engaged in mining in Ainsworth mining division, left British Columbia on March 6th to visit St. Paul and Chicago.

Mr. W. G. Norrie, superintendent of the Silver Standard mine, near Hazelton, Omineca division of British Columbia, was in Seattle, Washington, and Vancouver, B.C., last month, in connection with the purchase of mining machinery for the further equipment of the Silver Standard mine, which last year shipped 651 tons of silver-lead ore to Trail, B.C., and 209 tons of silver-zinc ore to the United States.

Mr. Wm. Thomlinson will shortly return to New Denver, B.C., his duties in connection with the exhibition of minerals at San Diego, California, by the Canadian Exhibition Commission, ending with the closing of the Pacific-California Exposition at the end of March.

Mr. O. B. Smith, superintendent of mines for the Granby Consolidated M. S. and P. Co., returned to the company's offices in Vancouver, B.C., about the middle of March after having spent a vacation in Southern California.

Mr. W. J. Watson, formerly manager for the Tyee Copper Co., will remain at Ladysmith, Vancouver island, B.C., for a while, acting in a consulting capacity for the new owners of the Tyee smeltery at that place.

Mr. W. E. Zwicky, manager of the Cork-Province silver-lead-zinc mines on the south fork of Kaslo river, Ainsworth division of British Columbia, went to Spokane, Washington, last month in connection with an endeavor to obtain more capital for the operation of the Cork mines and concentrating plant.

Mr. S. S. Fowler, general manager for the New Canadian Metal Co., operating the Bluebell lead-silver mine and concentrator at Riondel, Kootenay Lake, B.C., has gone to San Diego, California, for a few weeks' much-needed rest and change of climate.

Mr. A. C. Garde, formerly actively associated with silver-lead and zinc mining and milling in Slocan district of British Columbia, but of late years giving attention to the development of mining properties in the Northern Interior of the province, is now advocating the establishment of smelting works at Prince Rupert, the western terminal of the Grand Trunk Pacific railway.

SPECIAL CORRESPONDENCE

COBALT AND PORCUPINE.

Mining Corporation's New Plant.

The big high grade plant of the Mining Corporation of Canada (Cobalt Reduction Co.), at Cobalt, is running smoothly, and from early this month the concentrates will be treated in the new mill with the high grade ores from the mines of the company. All future shipments will be in the form of bullion and will be shipped to London. The new plant differs somewhat from that of the two other high grade plants in the camp in that amalgamation plays no part in the process. The ore is first slimed in a tube mill and after passing through two stages is dewatered and washed on an Oliver filter, then given a cyanide treatment and again filtered on a second Oliver. The silver is precipitated from the solution by means of a sodium sulphide. The silver sulphide is de-sulphurized by aluminum and refined in reverberatory furnaces to a high grade bullion which is cast into bars ready for shipment.

Sinking on Black Claim.

A contract has been let to sink the shaft on the Black Claim at Kirkland Lake from the 50 ft. to the 100 ft. level, and work is now under way. The Black Claim was recently optioned by Mr. Frank L. Cohen and associates of Buffalo. Should the work at present going on prove satisfactory it is understood that a small electrically driven plant will be installed early in the summer and further work done.

Schumacher.

Upwards of one thousand feet of diamond drilling was done during the month of February on the Schumacher property at Porcupine which compares with an average of between six and seven hundred feet per month for the past six months. All this work has been very favorable and a number of important orebodies and veins have been discovered. Working at the 200-ft. level of the No. 4 shaft a diamond drill encountered a vein which proved to be seventeen feet in width, while on the surface the same vein had a width of sixteen feet. This vein has also been cut about 75 ft. west of this working and was found to be eleven feet in width. This block of ore which has been definitely proven in the mine adds approximately eighty thousand tons to the company's reserves. Schumacher ore runs around six dolars per ton, therefore the new orebody will add materially to the proven intrinsic value of the mine.

La Rose.

According to the information received here last week it is understood the La Rose Mining Company, which had an option on the Maidens-McDonald claims in Deloro township, is not going to exercise their option on this property.

Tough-Oakes.

The Tough-Oakes Mining Company's report for the year ending Dec. 31st, 1916, shows the company to have mined 39.863 tons of ore from which was extracted $707,114. Ore averaged $17.85 per ton; milling costs, $2.43, and mining costs, $4 per ton; net profit was $260,668. Development for the year consisted of 9,437 ft. and was confined chiefly to veins Nos. 2, 3, and 6. Experimental work on the flotation process so far has not resulted in anything definite being determined upon, but work will be continued with the hope of finding a process which will result in a material reduction of the costs of treatment. The Charlton Power Company from which the Tough-Oakes obtained its power supply has closed down and the company is now using entirely electric power recently made available in the Kirkland Lake district by the Northern Ontario Light and Power Company, and will have sufficient power for all the future requirements of the mine.

Wright Porcupine Mines.

The Wright-Ferneri-Williamson claims in Deloro township, about two miles south from the Tisdale line, have been purchased and will be operated by a company known as the Wright Porcupine Mines, Ltd. A number of promising veins have been uncovered on the eighty acres of ground owned by the company. Camp buildings have been erected and an up-to-date plant installed. The main shaft has reached a depth of ninety ft., and the vein which was thirty ft. wide on the surface has widened out to thirty-five ft. at this depth. The shaft will be continued to the 300 ft. level and will be a two compartment shaft. At the three hundred ft. level lateral work will be carried on, and it is also the intention of the company to explore their property at every hundred ft. level.

Increasing Power Plant.

The Northern Ontario Power Company is increasing the capacity of its power plant at Wawaitin Falls. The present capacity of the plant is something like 8,000 h.p., and the company is now working on the installation of a 2,500 h.p. unit, which will be followed by another of the same size within the next few months.

A dam is to be built across the Red Sucker river at a point a short distance below the mouth of Cripple creek, to divert these two streams into the Matagami, which will greatly increase the volume of water flowing over the company's turbines at Wawaitin.

Porcupine Crown.

The work of installing the plant on the Hennessey claims in Deloro township, about three and a half miles from Timmins will be commenced shortly. These claims are under option to the Porcupine Crown Mining Company at a large figure, and the work of erecting camp buildings of all kinds is now about completed. The Hennessey is located on the contact between a rusty schist and Keewatin greenstones, which runs northeast through Deloro township and is situated less than a mile from the Hayden mines. Satisfactory results are being encountered at the 300-ft. level of the Hayden mines.

Gold Reef.

The Porcupine Gold Reef is working at the present time on a narrow but very rich vein, and stoping is now being carried on about fifty feet from the surface and one hundred ft. of lateral work has also been done on the property. The work is being done by the rather slow process of hand drilling. The management expects to ship a small amount of ore about May 1st.

Murray-Mowgridge.

About sixteen men are engaged at the Murray-Mowgridge, situated at Wolfe lake, about three miles from Bourkes' siding, and the machinery for the plant is expected to arrive any day now. Comfortable camp buildings have been built for the men and also office quarters for the office staff. Development work has been going on in the south shaft during the winter, and it is reported that very favorable results have been obtained.

North Dome.

It is reported here that the Dome Mines are negotiating for an option on the North Dome. The North Dome is situated immediately north of the Dome extension, on which the Dome Mines now hold an option, and the property consists of one hundred and twenty acres. Some very spectacular discoveries of gold were made on the North Dome in 1911-1912. Should the Dome Mines acquire this property and the Dome Extension, they would have an area of five hundred and sixty acres.

Discovery on McKinnon Claims.

Mining operations have been going on quietly for some time on the McKinnon-Ogilvie claims in the north-east corner of Pacaud township, in the Boston Creek district, and it was announced last week that a rich discovery of gold had been made. This property is situated a little north of the Miller Independence, which has been operating very successfully for some time.

Trethewey.

The Trethewey Mining Company, of Cobalt, has installed the Groch flotation system in the mill here and it is understood to be working satisfactorily. A Groch machine is also being used at the Coniagas Mine and is proving very successful.

Wright-Hargraves.

An 8 x 10 hoist was shipped from here to the Wright-Hargraves at Kirkland lake last week, and will be installed at the No. 3 shaft, where it is the intention of the management to sink to the 300 ft. level. Already 108 ft. of sinking has been accomplished at this point. The No. 2 shaft is now down to the 100-ft. level where a station will be cut. It is intended to sink this shaft to the 300-ft. level also, and when this depth is reached a drift will be run to connect up the two shafts a distance of 900 feet. Both these shafts are being sunk on the same vein, which is said to be traceable on the surface for nearly three thousand feet.

Staking in Cairo and Powell.

Private interests are said to be looking into the power possibilities of the Cairo and Powell mining field, about eighteen miles up the Montreal river from Elk lake, where considerable staking was done last fall and this winter. It is expected that the coming of spring will see quite a lot of activity in this district. The veins are very wide, and some have been proven to contain gold in encouraging quantities. Five hundred and seventy five claims have already been recorded in this neighborhood.

Claims Optioned.

The Skyjonsby claims, which were the original gold discovery east of Bourkes' siding, have been optioned to a number of Toronto men and preparations for their development are said to be under way at present. The claims are situated about three miles east of the station and are quite close to the famous Wickstead claims, which were purchased by Mr. N. E. Malouf, for a large sum.

McCrea Claims Sold.

The first payment on the purchase of the McCrea property at Boston Creek, was made in Haileybury on Saturday, when the sum of $3,000 was paid by Messrs. McKinnon and Ogilvie of Montreal for these claims. The total purchase price has not been announced but it is said to be a large one. This claim was at one time under option to the Crown Reserve Mining Company, and a small amount of exploring work was done, including the sinking of a shaft to the depth of about eighty feet. However, the vein was found to have a dip towards the Renaud claims adjoining on the north, and this was supposed to be the reason for the Crown Reserve dropping their option. Messrs. McKinnon and Ogilvie purchased the Renaud claims and developments on this property have proven so satisfactory that it was thought advisable to purchase the McCrea claims also. High grade ore is said to have been found in considerable quantities on the Renaud claims.

$10,000,000 ANNUALLY FOR WAGES AND SUPPLIES.

According to the Ontario Nickel Commission it takes $10,000,000 to pay the wages and provide the supplies for the Sudbury nickel mines for twelve months.

The public accounts placed before the Legislature of British Columbia at its opening on March 1 included the following receipts from the mining industry of the Province for the last fiscal year:

From Free miner's certificates	$ 47,920 80
Mining receipts, general	59,277 85
Mineral tax	163,335 58
Tax on unworked Crown-granted mineral claims ...	35,703 23
Bureau of Mines	884 25
Royalty and tax on coal	173,261 75
	$480,383 46

In addition there are various sources of revenue not segregated, so it appears a reasonable estimate to place the year's total revenue from the mining industry of the Province at a sum in excess of $500,000.

NICKEL REFINERY AT MURRAY MINE.

At the British-America Nickel Corporation's refinery the Hybinette electrolytic process will be used. The plant planned will have a capacity of 5,000 tons per year. The refinery will probably be erected at Murray Mine.

GOLD IN TEMAGAMI RESERVE.

The Golden Rose property, near Emerald Lake, in the Temagami Forest reserve, will be explored this year. Gold occurs in flat quartz veins in the iron formation.

SILVER PRICES.

	New York. cents.	London. pence.
February 24	77⅜	37⅝
" 26	77⅛	37½
March 6	76⅜	37 3/16
" 7	75½	37 3/16
" 8	75⅜	37⅛
" 9	75⅞	37 5/16
" 10	75½	37⅛
" 12	75	36⅞
" 13	74¼	36½
" 14	73¼	36
" 15	73	35⅞
" 16	73	35⅞
" 17	73	35 15/16
" 19	72⅞	36 3/16
" 20	72⅜	35 15/16

MARKETS

TORONTO MARKETS.

Cobalt oxide, black, $1.05 per lb.
Cobalt oxide, grey, $1.15 per lb.
Cobalt metal, $1.25 to $1.50 per lb.
Cobalt anodes, $1.50 to $1.75 per lb.
Nickel metal, 45 to 50 cents per lb.
White arsenic, 5½ to 6 cents per lb.

Mar. 23, 1917—(Quotations from Canada Metal Co., Toronto)—
Spelter, 14 cents per lb.
Lead, 12½ cents per lb.
Tin, 60 cents per lb.
Antimony, 35 cents per lb.
Copper, casting, 37 cents per lb.
Electrolytic, 39½ cents per lb.
Ingot brass, yellow, 23 cents; red, 25½ cents per lb.

Mar. 23—(Quotations from Elias Rogers Co., Toronto)—
Coal, anthracite, $9.50 per ton.
Coal, bituminous, nominal, $9.75.

NEW YORK MARKETS.

Connellsville coke—
Furnace, spot, $9.50 to $10.50.
Contract (nominal), $7.00 to $8.50.
Foundry, spot, $11.00 to $12.00.
Contract, $7.50 to $8.50.
Straits Tin, spot, f.o.b. nominal, 55.50 cents.
Copper—
Prime Lake, nominal, 35.00 to 35.50 cents.
Electrolytic, nominal, 35.50 to 36.00.
Casting, nominal, 31.25 to 31.75 cents.
Lead, Trust price, 9.00 cents.
Lead, outside, nominal, 9.62½ to 9.87½ cents.
Spelter, prompt western shipment, 10.55 to 10.80 cents.
Antimony, Chinese and Japanese, nominal, 34.00 cents.
Aluminum—nominal—
No. 1 Virgin 98-99 per cent., 58.00 to 60.00 cents.
Pure, 98-99 per cent. remelt, 54.00 to 56.00 cents.
No. 12 alloy remelt, 38.00 to 40.00 cents.
Powdered aluminum, 85.00 to 90.00 cents.
Metallic magnesium—99 per cent. plus, $3.00 to $3.50.
Nickel—shot and ingot, 50.00 cents.
Electrolytic, 55.00 cents.
Cadmium, nominal, $1.45 to $1.50.
Quicksilver, $120.00.
Platinum—
Pure, $105.00.
10 per cent. Iridium, $110.00.
Cobalt (metallic), $1.70.
Tungsten, per unit—
Sheelite, $17.50.
Wolframite, $17.00.
Silver (official), 72⅜ cents.

Metal Products—Following quotations represent mill prices and are strictly nominal except in the case of lead sheets and sheet zinc:
Sheet Copper—
Hot rolled, 44.00 cents.
Cold rolled, 45.00 cents.
Copper bottoms, 52.00 cents.
Copper in rods (round), 42.00 cents.
Square and rectangular, 43.00 cents.
Copper wire, nominal, 40.00 to 42.00 cents.
Copper wire, April, May, 37.00 to 39.00 cents.
High brass—
Sheets, 39.00 to 40.00 cents.
Wire and light rods, 40.00 cents.
Heavy rods, 38.50 to 39.00 cents.
Low Brass—sheet wire and rods, 42.00 cents.
Tubing—
Brazed bronze, 51.75 to 52.00 cents.
Brazed brass, 48.00 to 49.00 cents.
Seamless copper, 47.50 to 50.00 cents.
Seamless brass, 43.00 to 47.00 cents.
Seamless bronze, 54.00 cents.
Full lead sheets, 11.00 cents.
Cut lead sheets, 11.25 cents.
Sheet zinc, f.o.b. smelter, 21.00 cents.

STOCK QUOTATIONS.

As of close March 22nd, 1917.
(By courtesy of J. P. Bickell & Co., Toronto.)

Ontario Gold Stocks.

	Bid.	Asked.
Apex	.09	.09⅛
Boston Creek	1.16	1.18
Davidson	.80	.82
Dome Consolidated	.05	.11
Dome Extension	.26	.26½
Dome Lake	.19	.20½
Dome Mines	18.00	18.50
Gold Reef	.03¾	.04¼
Hollinger Consolidated	5.20	5.25
Inspiration	.14	.15
Jupiter	.31	.32
Kirkland Lake	.44½	.47
McIntyre	1.86	1.87
Moneta	.12½	.13
Newray	1.30	1.31
Porcupine Crown	.63	.65
Porcupine Gold	.01	.02
Porcupine Imperial	.03½	.03⅞
Porcupine Tisdale	.02	.02⅜
Vipond	.44¼	.45
Preston East Dome	.04¾	.05
Schumacher	.58	.60
Teck Hughes	.71	.74
West Dome	.28¼	.28½
Gould	...	.00⅜
Great Northern	.15	.16
Hargraves	.20	.20½
Hudson Bay	...	45.00
Kerr Lake	4.30	4.50
La Rose	...	.53
Lorrain Con.	.33	.35
McKinley-Darragh-Savage	.51	.52
Nipissing	8.00	8.15
Ophir	.10¼	.10½
Peterson Lake	.12½	.12¾
Right of Way	.05	.06
Rochester Mines	...	.03½
Seneca Superior	.01½	.02
Silver Leaf	.02¼	.02½
Shamrock Cons.	.20½	.22
Temiskaming	.51	.52½
Trethewey	.16½	.17
Wettlaufer	.07½	.08
York, Ont.	.02⅛	.03

New York Curb.

	Bid.	Asked.
Boston and Montana	.65	.66
Butte Detroit Copper	1.06	1.18
Canada Copper	1.87	2.00
Dome Extension	.26	.27
Hargraves	.20	.21
Inter. Petroleum	13.25	13.75
Kerr Lake	4.37	4.50
La Rose Con.	.50	.54

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