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CANADIAN MINING JOURNAL

VOL. XXXVI

TORONTO

No. 9



The Canadian Mining Manual

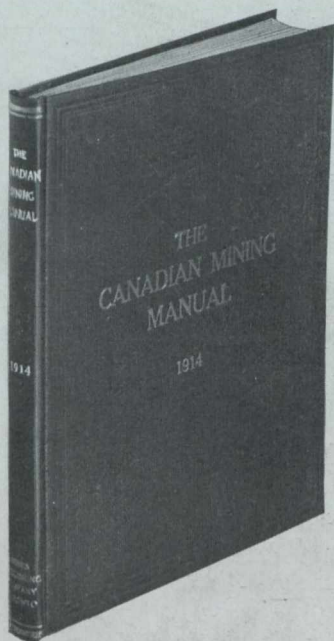
is a handbook of information concerning the mining industry in Canada.

The first part of the book gives general information concerning the chief minerals produced in the Dominion, and reviews by provinces.

The second part "Mining companies operating in Canada," gives useful information concerning location and character of properties, capitalization, officers, results of operations, etc. Companies are listed alphabetically and also according to product.

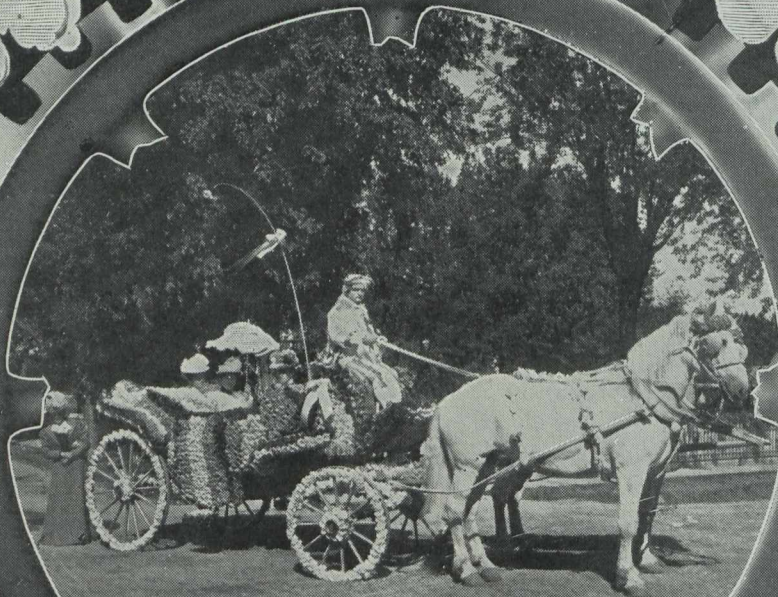
The book of 280 pages is well illustrated, printed on good paper, and bound in cloth. The price is \$2.00 post paid. Shall we send you a copy?

Book Dept., Canadian Mining Journal,
44-46 Lombard Street, Toronto.



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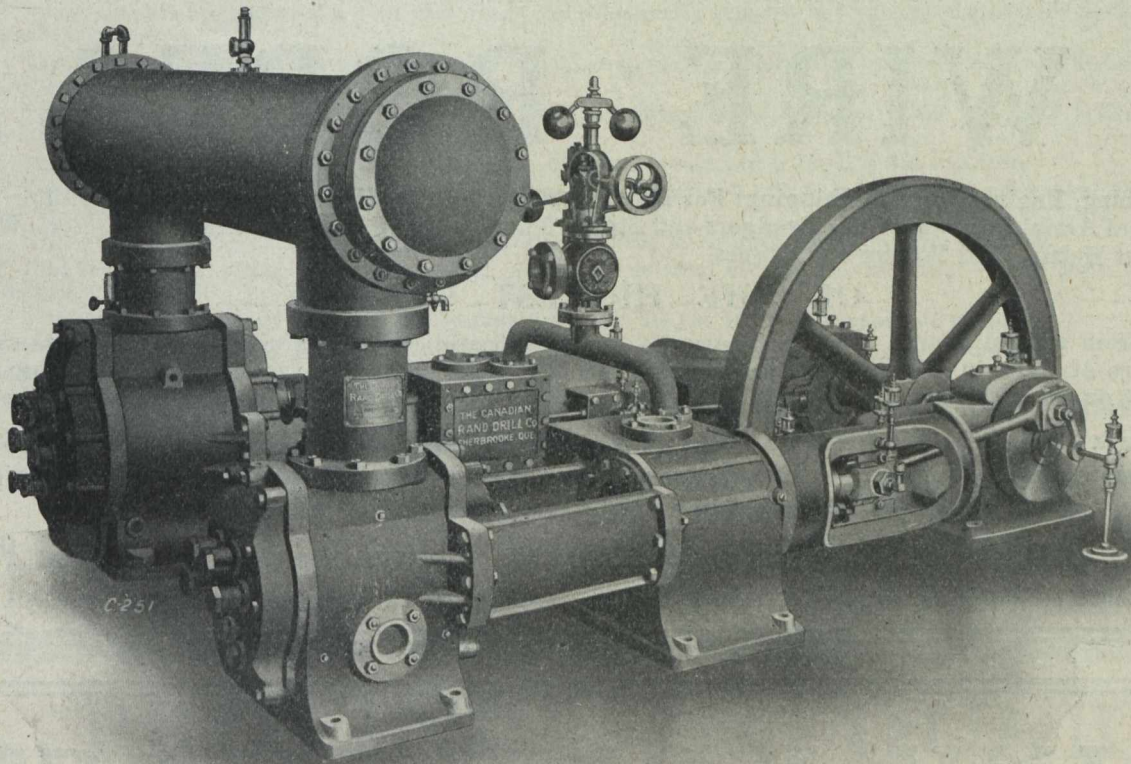
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The Mining Law gives absolute security of Title and is very favourable to the Prospector.

MINERS' CERTIFICATES. First of all, obtain a miner's certificate, from the Department in Quebec or from the nearest agent. The price of this certificate is \$10.00, and it is valid until the first of January following. This certificate gives the right to prospect on public lands and on private lands, on which the mineral rights belong to the Crown.

The holder of the certificate may stake mining claims to the extent of 200 acres.

WORKING CONDITIONS. During the first six months following the staking of the claim, work on it must be performed to the extent of at least twenty-five days of eight hours.

SIX MONTHS AFTER STAKING. At the expiration of six months from the date of the staking, the prospector, to retain his rights, must take out a mining license.

MINING LICENSE. The mining license may cover 40 to 200 acres in unsurveyed territory. The price of this license is Fifty Cents an acre per year, and a fee of \$10.00 on issue. It is valid for one year and is renewable on the same terms, on producing an affidavit that during the year work has been performed to the extent of at least twenty-five days labour on each forty acres.

MINING CONCESSION. Notwithstanding the above, a mining concession may be acquired at any time at the rate of \$5 an acre for SUPERIOR METALS, and \$3 an acre for INFERIOR MINERALS.

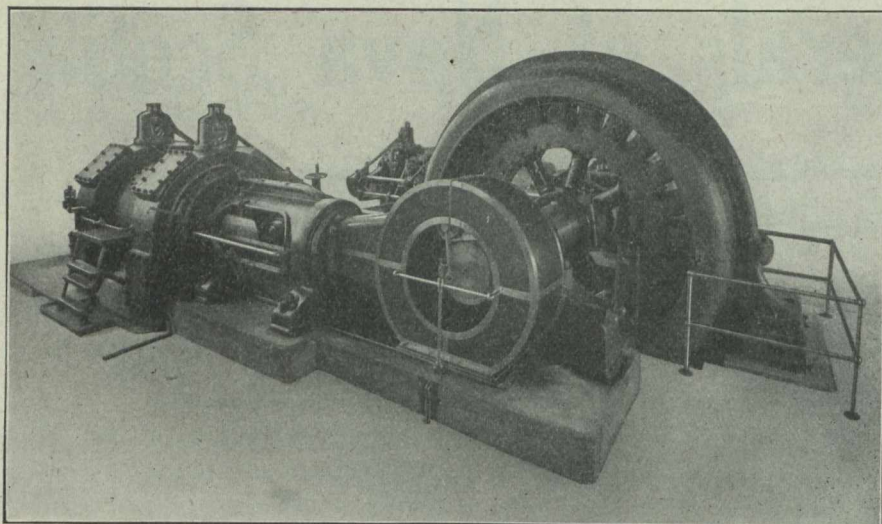
The attention of prospectors is specially called to the territory in the North-Western part of the Province of Quebec north of the height of land, where important mineralized belts are known to exist.

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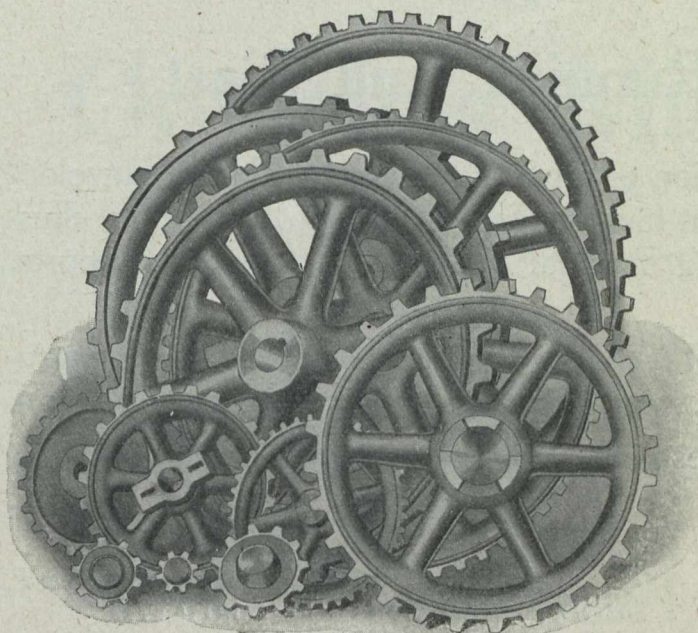
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Synopsis of Coal Mining Regulations

COAL mining rights of the Dominion, in Manitoba, Saskatchewan and Alberta, the Yukon Territory, the North-West Territories and in a portion of the Province of British Columbia, may be leased for a term of twenty-one years at an annual rental of \$1 an acre. Not more than 2,560 acres will be leased to one applicant.

Application for a lease must be made by the applicant in person to the Agent or Sub-Agent of the district in which the rights applied for are situated.

In surveyed territory the land must be described by sections, or legal sub-divisions of sections, and in unsurveyed territory the tract applied for shall be staked out by the applicant himself.

Each application must be accompanied by a fee of \$5 which will be refunded if the rights applied for are not available, but not otherwise. A royalty shall be paid on the merchantable output of the mine at the rate of five cents per ton.

The person operating the mine shall furnish the Agent with sworn returns accounting for the full quantity of merchantable coal mined and pay the royalty thereon. If the coal mining rights are not being operated, such returns should be furnished at least once a year.

The lease will include the coal mining rights only, but the lessee may be permitted to purchase whatever available surface rights may be considered necessary for the working of the mine at the rate of \$10.00 an acre.

For full information application should be made to the Secretary of the Department of the Interior, Ottawa, or to any Agent or Sub-Agent of Dominion Lands.

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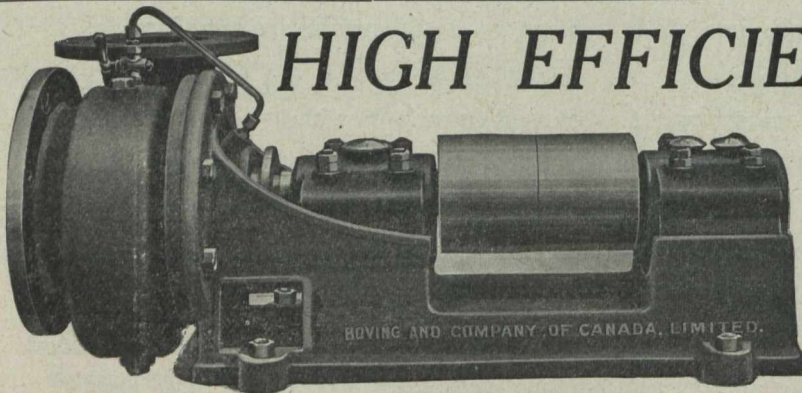
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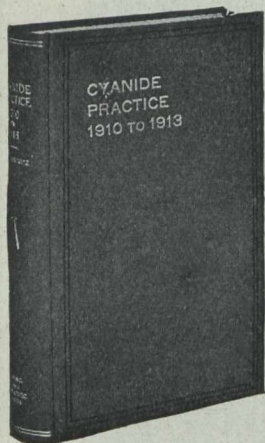
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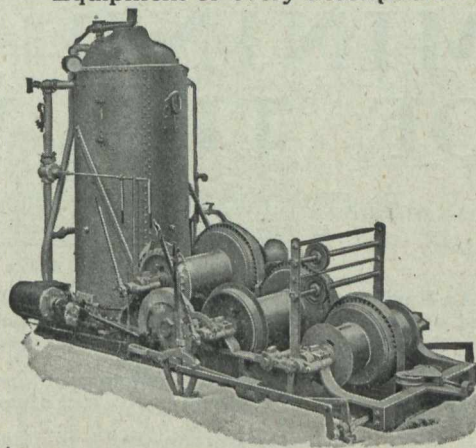
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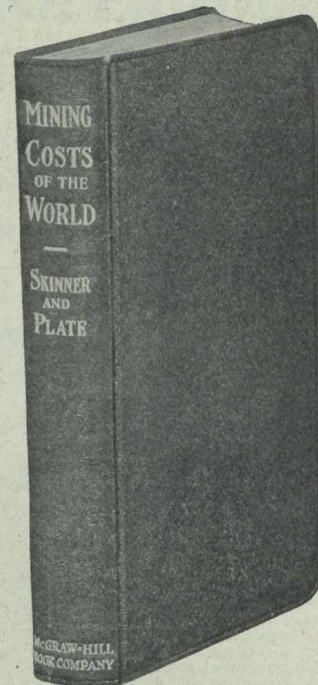
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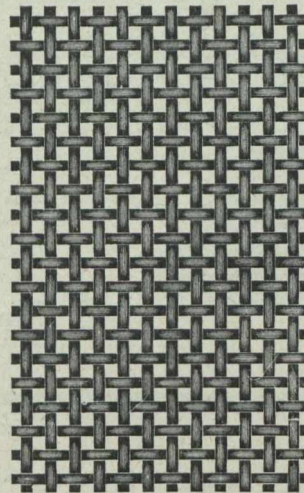
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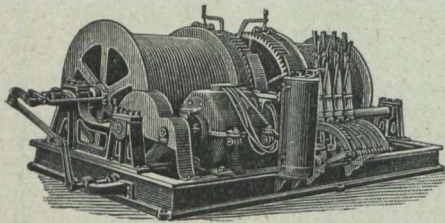
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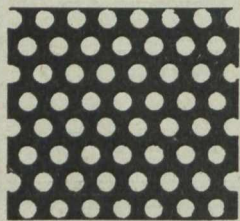
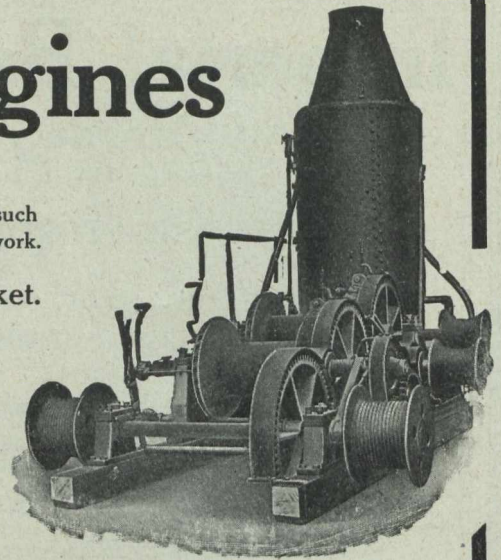
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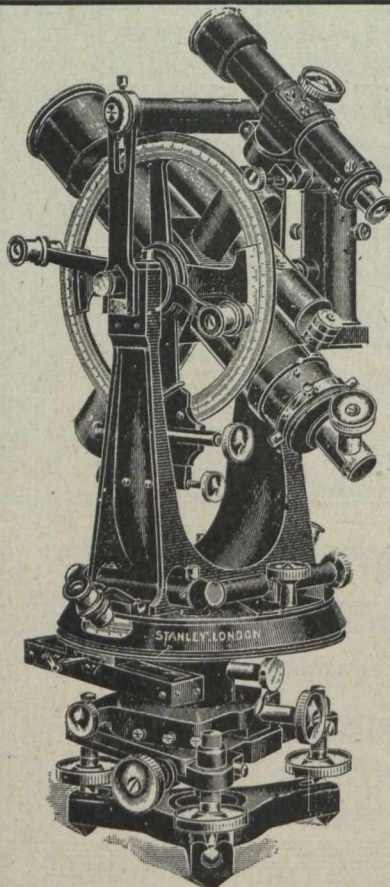
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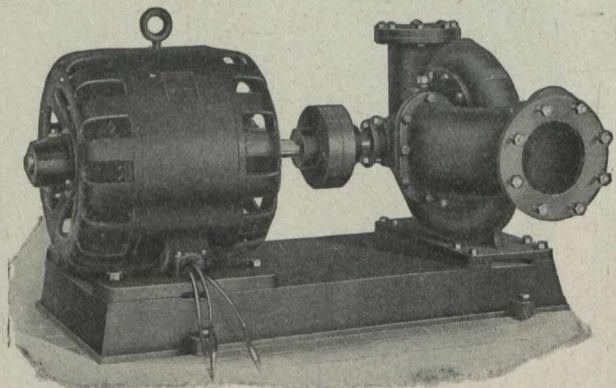
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Aggregate Value of \$460,433,920

The substantial progress of the Mining Industry of this Province is strikingly exhibited in the following figures, which show the value of production for successive five-year periods: For all years to 1888, inclusive, \$69,598,850; for five years, 1889-1893, \$15,079,632; for five years, 1894-1898, \$38,738,844; for five years 1889-1903, \$83,807,166; for five years, 1904-1908, \$116,153,067; for five years, 1909-1913, \$137,056,361.

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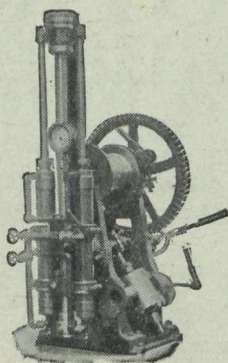
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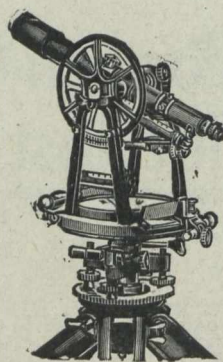
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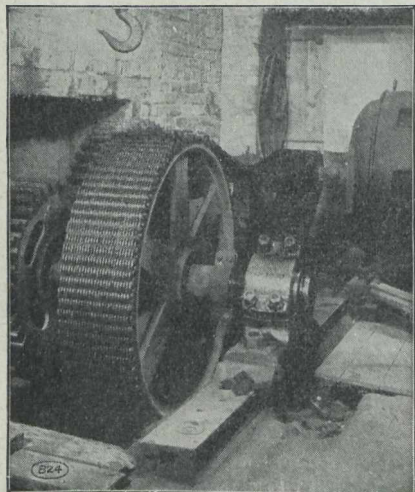
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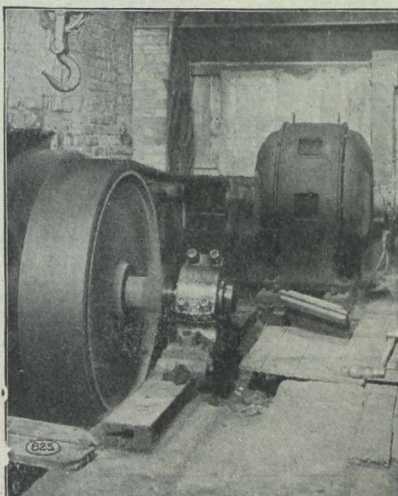
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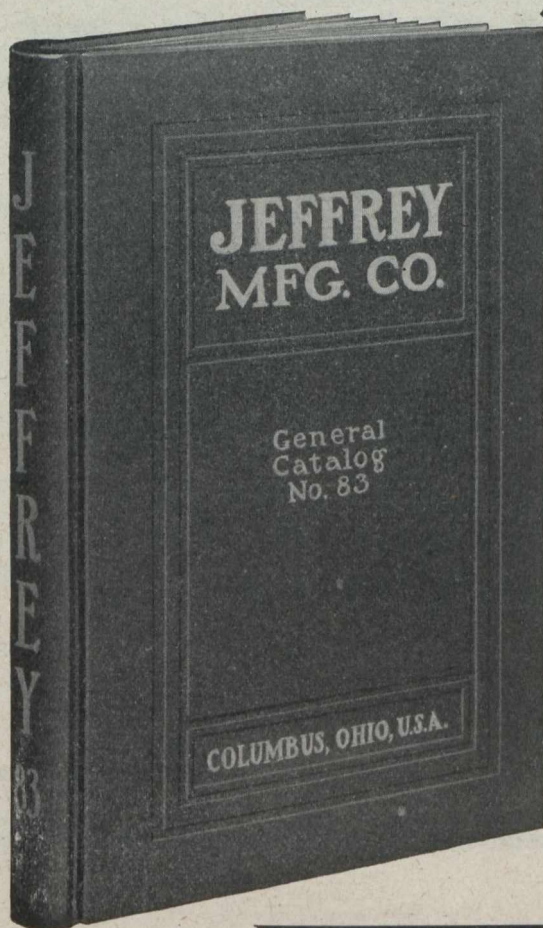
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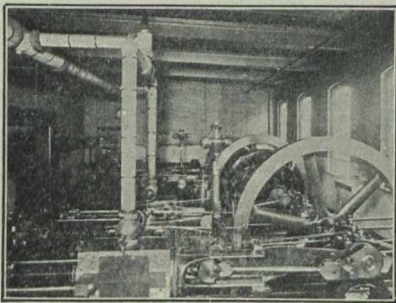
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The present performance of these blocks in service is surpassing our Own expectations and some mining men have already expressed their gratification as to their stability in service.

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THE CANADIAN MINING JOURNAL

VOL. XXXVI.

TORONTO, May 1, 1915.

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The Canadian Mining Journal

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REGINALD E. HORE

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BRITAIN CONTROLS COPPER OUTPUT

The announcement that Great Britain is now in control of the world's copper supply, outside of Germany, is a source of great satisfaction. The enemy has been for years a large consumer of copper and has been unable to produce enough for his own use. For war purposes much larger quantities than before are needed and the Germans have made every effort to obtain supplies. That the British blockade is effective is clearly disclosed by the announcement that even those American companies controlled by Germans have entered into the agreement to put their output under British control.

The significance of this announcement cannot be overestimated. It shows clearly that the War Office officials responsible for the control of the supply of metals are capable of doing things which few men would have thought possible. While some of our newspapers have been at great pains to tell the Government how the nickel output should be controlled, the War Office has been quietly obtaining control of the supply of copper. Comparatively the control of nickel is a very simple matter. The control passed into the British hands practically with the opening of the war. But while most of the nickel comes from a few mines in Canada, copper is produced in large quantities in many parts of the world. That all producers have been satisfactorily dealt with by the British Government speaks volumes for the effectiveness of the blockade, for the magnitude of Kitchener's plans and for Britain's determination to push the war to a victorious conclusion.

THE DEMAND FOR COPPER

Copper is now commanding a higher price than for years. Nearly every week the producer's position is improved. The supply on hand is low and several companies are reported to be sold out for two or three months ahead. A tremendous change has taken place. Copper producing companies are in a position which contrasts sharply with their position last September.

The average price for copper over a period of several years has been about 14 cents per lb. Most successful companies make a profit of only a few cents per lb. Very few produce at a cost of less than 10 cents. The rise from 11 cents last August to the present price of 18 cents for electrolytic and 20 cents for Lake copper is therefore doubling, tripling or quadrupling the profits of some companies. In several cases companies operating at a loss last fall are now making large profits.

Obviously the war is responsible for the improved market for copper. The price has risen in the face of great increase in production and seems likely to rise in spite of the strenuous efforts now being made to take advantage of the good market. Last fall production was only one half normal and the outlook gloomy. Now copper mines everywhere are employing more men and are yet scarcely able to meet the demand.

The amount of copper used for ordinary purposes is certainly much below normal. It is becoming apparent that this is more than made up for by the use for war purposes. That such would be the case was predicted by many, but the demand for the metal in the early months of the war did not indicate that these predictions would be fulfilled. Now the demand seems insatiable and copper mining is likely to be one of the most profitable industries during the war and probably for some time after it. Much of the copper being used now will never be recovered. The demand for ordinary and reconstruction purposes after the war should be great and the copper producers will be called upon to supply enormous amounts.

PROPOSED METAL REFINERIES IN BRITISH COLUMBIA

What was described as "one of the most important commissions which has visited Victoria for a long time" arrived at Nelson, British Columbia, early in April and after spending several days there and at Trail, proceeded to the coast, reaching Victoria on April 10, and a week later, after having first been in Vancouver two or three days, left on the return journey eastward. The party consisted of Mr. David Carnegie, of London, England, stated in the local press to be a special representative of the British War Office; Dr. Alfred W. G. Wilson, chief of the Mental Mines Division Mines Branch of the Canada Department of Mines and Dr. Alfred Stansfield, professor of metallurgy at McGill University.

The Daily Colonist, Victoria, made the announcement that "in an interview Mr. Carnegie stated that their mission in British Columbia was to investigate the feasibility of establishing copper refineries, besides enquiring into the facilities for manufacturing shells and other munitions of war here." In a report of the proceedings at a meeting of the mining committee of Victoria board of trade with the commission, Mr. Carnegie is stated to have given the local men information, including the following:

"The larger part of the project, however, was to secure, if possible, the smelting and refining of all our copper supplies within the Dominion, and when this subject has been satisfactorily dealt with, it is hoped the refining of zinc would follow.

"In a normal year Canada produces 35,000 tons of copper matte. This is all exported to the United States because we have no refineries; 21,000 tons is

reimported in the form of finished copper, in addition to 3,000 tons of brass of which copper forms a large part. It is desirable that this work shall be done in Canada, not only as a means of increasing our industrial prosperity, but also as a means of conserving so important an article as copper for the use of the Empire."

The report also stated that Mr. Carnegie asked for the assistance of the committee in assembling such data as would enable the commission to decide whether copper refining would prove to be a commercial proposition in normal times, and if so where would be the best place at which to establish a refinery.

The value of a part of the information offered to the commission may be gauged by some of the statements published relative to the output of copper. A Kootenay newspaper stated that: "Last year the production of copper in British Columbia exceeded 50,000,000 lbs., and estimating this year's output upon production during the first two months of 1915, it will reach about 100,000,000 lbs." As a matter of fact the production of copper in British Columbia in the first quarter of 1915 was little, if any, larger than in the corresponding period of 1914, for while the Coast district most likely produced more in the first quarter of the current year than in that of last year there was a considerable decrease in output of the Boundary and a loss of production in Nelson mining division. Further, the total production of copper in British Columbia in 1914 was estimated by the Provincial Department of Mines at 44,969,000 lbs., and by the Dominion Department of Mines at 41,222,000 lbs.

Then, an excerpt from the annual report of the Victoria Board of Trade published in the Victoria Daily Times included the following: "Just at the close of our official year a movement has developed which may have important consequences on the mining and smelting industries of British Columbia. The movement arises out of the importance which copper has assumed in connection with the war." After summarizing the objects of the visits of the commission that members of the board had interviewed a few days previously and using Mr. Carnegie's figures relative to copper production, the report continues: "The policy of our government, with a view to carrying out the wishes of the Home government, is to conserve the natural resources of the Empire for use within its borders, and especially to retain absolute control of such resources as are indispensable to the protection of the Empire. One of the most important steps in this direction would be the refining of copper in Canada. All Canadian copper is produced in British Columbia, which makes this for us a domestic question." Then follow some figures, which are but poor guesses.

Now, as to the statement that all Canadian copper is produced in British Columbia—the following figures taken from reports of the chief of the Division of Mineral Resources and Statistics, Canada Department of Mines, will show its unreliability:

Production of Copper by Provinces 1913 and 1914.

Provinces.	1913. lb.	1914. lb.
Quebec.	3,455,887	4,201,497
Ontario.	25,885,929	28,948,211
British Columbia	45,791,579	41,221,628
Other districts	1,843,530	1,367,050
Totals.	76,976,925	75,738,386

These official figures show that last year British Columbia's proportion was about 55 per cent. and in 1913 nearly 60 per cent., of the production of the whole of the Dominion. Other districts include Nova Scotia and Yukon. It should be added that the figures for 1914 represent the estimated production, final statistics not yet being available.

It is evident that some of the information professed is misleading, but that might have been expected from irresponsible persons. Why it was sought in that way does not appear on the face of it, for no men investing their own money in any industry would be likely to ask uninformed individuals to supply them with important data. But apart from this, the desirability of established copper refinery in British Columbia is unquestionable. Whether it will be found practicable to enter into such an undertaking can only be dealt with on its merits. It is to be hoped that such obstacles as exist will be overcome and that the growing copper-producing industry of the province will be benefited accordingly.—E. J.

An amendment to the Mining Act of Ontario passed at the recent session of the Legislature, waives forfeiture for any cause in the case of mining claims held by those enlisted for active service. It would be distinctly unfair to hold enlisted men to the conditions provided by the Act and some such action on the part of the Government was confidently expected.

The ineffectiveness of Germany's blockade of the British Isles is reflected in the announcement that in March there was imported 44,000,000 gallons of petroleum, without the loss of a single oil tanker. Stocks in Great Britain are larger than they have been for several months.

The Granby Consolidated Mining Smelting & Power Co. is among the companies which will benefit greatly by the high price of copper. Granby's mine at Hidden Creek is a low cost producer; but the old mine at Phoenix is operated on a small profit per lb. at ordinary times and was closed down last August when the price fell to nearly 11 cents per lb.

Germany's finance minister boasts that owing to that country's isolation all her expenditures are necessarily made at home and that consequently Germany is prospering. If Germany's finances are not more sound than her minister's methods of reasoning our enemy is indeed in a bad way.

YPRES

In summertime a tourist stray would come—
 For thou wert somewhat from the beaten way —
 And in thee, drowsing by thy still canal,
 Find charm and treasure-trove for half a day.

Thumbing his guidebook to thy buried page,
 He'd find three-starred, as worth his roving eye,
 Thy Cloth Hall's noble beauty, fresh restored,
 And brave St. Martin's tower, standing by.

And from his text, and from the misty lore
 Drawled slow and broken by his Fleming guide,
 Would catch some hint, from days of Charles the Bold,
 Of what were once thy glory and thy pride,—

How thou, twelve times more populous, did'st boast
 Five thousand looms—the world's prime weaving
 spot;
 And, faring from thy shrunken streets would muse
 "Queer town, queer-named,—forevermore forgot!"

So, many summers,—then, one winter, spring,
 And fame is thine again forevermore:
 On thee the men of kaiser and of king
 Have, with their hearts' blood, set their rival store.

Thy fame is loud—thy hall's, cathedral's crash
 And scream of shell its renaissance now give;
 In soldiers' gossip and in widows' moan
 Lasting thy name—as place of death—shall live!
 —B. F. Griffin.
 Boston News Bureau.

GRANBY CONSOLIDATED.

According to the Boston News Bureau, Granby Consolidated will next week be running full blast at its Grand Forks smelter, where for the past two months six of the eight furnaces have been in commission. The two idle sections will be blown in very shortly. By July the fourth furnace will have been installed at the Anyox smelter permitting of continuous operation of at least three units.

Granby's net earnings from April operations will approximate \$175,000 based on copper under 17 cents and with the Grand Forks plant running but 75 per cent. of capacity. At Anyox there will have been treated at the new smelter 55,000 tons of ore which, yielding 35 lbs. of copper per ton, should show a production of about 1,900,000 lbs. of copper.

Eighteen-cent copper and full operations mean \$25 per share for Granby. Cost of producing copper at Hidden Creek has been below 8 cents a lb., landed at New York, while the cost of turning out the metal at the old plant at Grand Forks hangs around 10½ cents a lb.

Allowing an eight-cent cost at the new smelter and 10½ cents at the old plant, Granby earnings per share at varying copper metal prices should be about as follows:

Copper at	Per share	Bond int.	Net per share
18 cents	\$25.40	\$.60	\$24.80
17 cents	22.52	.60	21.92
16 cents	19.64	.60	19.04
15 cents	16.14	.60	15.54
14 cents	13.26	.60	12.66

The company has outstanding \$1,500,000 6 per cent. convertible bonds the interest on which amounts to \$90,000 a year. There is also an issue of \$850,000 non-convertible and a small floating debt. Satisfactory arrangements have been made for caring for maturing obligations.

CORRESPONDENCE

To the Editor of the Canadian Mining Journal:

Sir,—In your issue of April 1, Mr. F. W. Gray comments on the address on "The Conservation of our Mineral Resources" delivered by Dr. F. D. Adams at the recent annual meeting of the Canadian Mining Institute. In reference to Dr. Adams' statement respecting the provisions of the Nova Scotia Act requiring advance plans before a mine can be opened, Mr. Gray says:—"There is a misapprehension here, as the Government of Nova Scotia only requires advance plans to be submitted for approval in case of submarine coal areas. Advance plans are not required in case of land areas."

Mr. Gray refers to the Coal Mines Regulation Act and has evidently overlooked the Mines Act.

The Mines Act reads as follows:—Section 233. Before the work of opening any coal mine, after the passing of this Act, is begun, a plan of the coal areas proposed to be operated by any person, firm or Company, shall be submitted to the Commissioner of Public Works and Mines for the approval of the Governor-in-Council, showing the place or places at which proposed shafts or slopes are to be sunk or driven, and the area of coal to be won by each shaft or slope, and making provision for the operation of riding rakes therein, and a plan showing the number of seams to be worked at one time, the proposed system of underground workings and a calculation of percentage of coal to be extracted from each seam.

—Yours etc.

CHARLES FERGIE.

Montreal, April 26, 1915.

CALUMET AND HECLA COPPER.

Makers of ammunition have been so anxious to get the best copper for their wares that they have willingly paid a premium of something like three cents a lb. for the Calumet & Hecla metal—known to the trade the world over as "C. & H." That particular grade of copper enjoys an enviable reputation, which has long been established in Europe, and the letters C. & H. have come to have something of the significance which attaches to a registered trade-mark, carrying a "good-will" which is readily translated into dollars and cents.

But it is not alone in munitions of war that C. & H. shines—literally and figuratively. The harmless, necessary shoe eyelet is made of Calumet & Hecla copper, combined with the best grades of zinc. Not only does the constant wear and tear on shoe eyelets demand a brass of the highest torsional and tensile strength, but the minuteness and peculiar shape of the eyelets, and the firmness with which they must clasp the leather, put a weak or brittle metal out of the running.

It is a far cry from ammunition to eyelets. C. & H. is supreme in both.—The Wall Street Journal.

CONSOLIDATED MINING AND SMELTING CO.

Consolidated Mining and Smelting Company, Trail B.C., state that the general feeling appears to be more confident than has been the case since the war started.

There was some difficulty experienced during the first four months of the war in disposing of products. At present, however, this matter is not troubling the Company at all.

The prospects for the coming six months, they state, appear to be very favorable.

The price of silver is very low, but both lead and copper are going out at fair prices.

GRANBY.

Granby Consolidated Mining, Smelting & Power Co. has sold \$2,000,000 6 per cent. convertible bonds to White, Weld & Co.

Granby Consolidated Mining, Smelting & Power Co. \$2,000,000 6 per cent. convertible bonds sold to White, Weld & Co. will be offered for subscription to stockholders of the company at par.

Through this sale the company will fund its entire floating debt and care for \$850,000 non-convertible debentures maturing May 15. A substantial addition to working capital will also be made and the way paved for immediate dividend resumption.

U. S. PRODUCTION OF COPPER IN 1914.

The smelter production of primary copper in the United States in 1914 was 1,150,137,192 lbs., as compared with 1,224,484,098 lbs. in 1913, a decrease of about 6.1 per cent.

The total value of the 1914 output at an average price of 13.3 cents per lb. is \$152,968,246, as compared with \$189,795,035 for 1913.

MINERS FOR GOLD COAST.

Cobalt, April 28.—Mr. Charles P. C. Beresford, manager of the Prestea Block A. Co., Prestea, Gold Coast Colony, Africa, is in Cobalt for a few days to engage about 30 miners to take places of men who have enlisted for active service at his property. Of the total white strength of 180 men at the Prestea mine, 60 have gone on active service and it is difficult to get miners in England at the present time.

INTERNATIONAL NICKEL.

New York, April 27.—International Nickel Common is 135 bid, with little stock offered. Sales, Monday were at 132½.

The earnings for the first quarter of 1915 ran away ahead of last year, and the increase is conservatively estimated at about 35 per cent. April, it is said, will be the largest month in the history of the company.

SCHOOL OF MINING.

Kingston, April 28.—At the annual meeting of the shareholders of the School of Mining, D. M. McIntyre, chairman of the Ontario Railway Commission, was in the chair. The retiring members of the board—J. B. Carruthers, N. F. Dupuis, M. L. Hersey and James Swift—were re-elected.

LAKE COPPER AT 21½ CENTS.

Boston, Mass., April 27.—Best grades of lake copper have been advanced to 21½ cents a lb., and the market is strong at this figure.

217,000 MINERS ENLISTED.

According to reports of Premier Asquith's speech at Newcastle last week, 217,000 miners in the British Isles have enlisted. This is a record to be proud of.

REVISION OF PRE-CAMBRIAN CLASSIFICATION IN ONTARIO

By Willet G. Miller and Cyril W. Knight.

During the past decade the authors have been engaged in detailed work on pre-Cambrian areas in various parts of the Province of Ontario. The results of this work, and that of other investigators, have made apparent the necessity for revising the age classification of the pre-Cambrian rocks, particularly in the use of the terms Huronian, Laurentian and others. The following classification and nomenclature have therefore been adopted by the Ontario Bureau of Mines:

Keweenawan

Unconformity

Animikean

Under this heading the authors place not only the rocks that have heretofore been called Animikie, but the so called Huronian rocks of the "classic" Lake Huron area, and the Cobalt and Ramsay Lake series. Minor unconformities occur within the Animikean.

Great Unconformity

(Algoman granite and gneiss)

Laurentian of some authors, and the Lorrain granite of Cobalt, and the Killarney granite of Lake Huron, etc.

Igneous Contact.

Timiskamian

In this group the authors place sedimentary rocks of various localities, that heretofore have been called Huronian, and the Sudbury series of Coleman.

Great Unconformity

(Laurentian granite and gneiss)

Igneous Contact.

Loganian

Grenville
(*Sedimentary*)
Keewatin
(*Igneous*)

The authors have found the Keewatin to occur in considerable volume in S.E. Ontario and have determined the relations of the Grenville to it.

Investigations by the junior author during 1914 have shown that certain rocks of the "classic" Huronian area of Lake Huron, the "Thessalon greenstones," that heretofore have been placed with the Keewatin, are of much later age, being in intrusive contact with the Animikean, as defined in the above table.

The preceding is an abstract of a paper presented by the authors at the last annual meeting of the Geological Society of America and printed with other abstracts by the Society. A few notes on the classification may be of interest from the economic point of view.*

The authors employ the name Keweenawan in the sense in which it has been used by most workers in the Lake Huron-Lake Superior country for a consid-

erable length of time. The Keweenawan rocks, especially the igneous representatives, are of much economic importance as associated with them are the great native copper deposits of Michigan. The basic intrusives that gave rise to the Sudbury nickel-copper deposits and the Cobalt silver ores are believed to be of the same age.†

It will be noted that the historic name Huronian is not employed, the rocks to which this name has been given by most authors, during recent years at least, being divided between the Animikean and the Timiskamian. Field work during late years, not only by the authors but by other investigators as well, has shown that the terms Lower, Middle and Upper Huronian have been employed in such a way in the past as to lead to great confusion. Rocks, for instance, in certain localities that are now known to be younger than what is called the Algoman granite, and to be separated from it by a great erosion interval, have been classed as Lower Huronian. On the other hand certain areas of rocks that antedate the Algoman, and are given the name Timiskamian in the table, have also been called Lower Huronian. Other points that have led to confusion in the use of the name Huronian might be cited, but briefly it may be said that the authors have thought it better to discard the name Huronian rather than apply it to only part of the rocks to which the name has been given in the past. Since it was on Lake Timiskaming, an expansion of the Ottawa river, in 1845 that Logan first studied the rocks to which he later gave the name Huronian, Timiskamian seems a most suitable appellation for the older of the two groups into which his Huronian is now known to be divisible.

While it may never be possible to prove that all of the rocks placed by the authors under the group name of Animikean are of one and the same age, it simplifies the classification for economic purposes, at least, to so group them in the meantime.

It may also be said that the grouping of certain areas of granite under the name Algoman is open to criticism, but in various areas are found granites that bear similar relationships to older and younger fragmental series respectively, and until these granites are proved to be different in age it simplifies the classification and can do little harm to consider them to be of one age, especially as these granites in numerous areas have the same economic significance, being the rocks to which the gold deposits owe their origin. Since auriferous orebodies occur in the fragmental rocks, to which the name Timiskamian is given, at Kirkland Lake, Porcupine and elsewhere, it is, of course, of much importance to distinguish this series from the fragmental group classed as Animikean and which, being later than the Algoman, does not contain ore deposits that owe their origin to these intrusives.

Erosion of Ore Deposits.

The intrusion of the Laurentian granite, in so far as can now be seen, did not give rise to ore deposits after the manner of the Algoman. But since Laurentian times there has been enormous erosion, and it is quite possible that orebodies that owed their origin to this

*See also Part 2, Vol. xxii, Ont. Bureau of Mines, pp. 122 to 138.
†Eng. and Min. Journ., June 7th, 1913, pp. 1131-1132.

granite have been removed. Considering that erosion has removed at least a few thousands of feet, there is little difficulty in picturing the destruction of numerous ore deposits of Laurentian origin. Even two or three hundred feet more of erosion in the epoch immediately preceding the deposition of the Paleozoic rocks would have left little of some of the greatest of pre-Cambrian mineral deposits. Comparatively little would have been left of the deposits at Cobalt, from which in all probability more ore was eroded than has been mined, or, for instance, of the great Mesabi iron deposits. While not entering on the recently much debated question as to the "persistence of ore in depth,"[†] it is quite clear to anyone with a knowledge of pre-Cambrian ore de-

deeply depressed in such areas than elsewhere by folding or faulting.

The Grenville Series.

It is believed by the authors that the key of the heretofore puzzling relationship of the Grenville to the Keewatin and the so-called Huronian has been found by them in southeastern Ontario. In their judgment the age relations of the Grenville have been made clear in their recently published report on southeastern Ontario.[‡] The Keewatin, consisting essentially of volcanic rocks, forms a floor on which the Grenville series rests, although part of the Grenville sediments are contemporaneous with later Keewatin flows. The



posits that a few hundred feet more of erosion would at least "have taken the cream off" most of the ore deposits. Indeed, were it not for the protection that has been afforded by faulting and folding, only a small part of the ore now available would have been preserved. It is worthy of note that the only Ontario gold mines that have proved to be commercial successes are in the vicinity of fragmental rocks, Timiskamian, which have been protected through having been depressed deeply in the crust by folding or faulting. The geological maps of the Porcupine and of the Kirkland Lake areas, published by the Ontario Bureau of Mines, show that the Timiskamian group occurs essentially in synclinal belts of steeply dipping, more or less schistose rocks. There is no evidence that erosion has been less in these areas than generally throughout the regions occupied by the pre-Cambrian protaxis. The preservation of these fragmental rocks in special areas would therefore appear to be due to their having been more

"iron formation" so widely associated with the Keewatin greenstones, and which is of such great economic importance in some localities, is considered to represent chemical sediments deposited in the lower part of the Grenville.

Indications of an early opening of navigation on the Yukon River are reported in advices received on April 15 by the agent at Vancouver, B. C., for the White Pass & Yukon route. Exceptionally warm weather for the time of the year was then being experienced in the North, the ice on the lower river had been practically broken up and that on Lake Labarge was already too thin for team traffic. No more shipments were being accepted for Dawson via the Lake. It is stated that the first steamer will likely leave Whitehorse about middle of May. This would be about three weeks earlier than usual.

[†]Inst. Min. and Met., Bulletin No. 122 et seq.
[‡]The Pre-Cambrian Geology of Southeastern Ontario, Part 2, xxii Report, Ont. Bureau of Mines.

THE MACKENZIE RIVER REGION*

By Charles Camsell.

The Mackenzie is one of the great rivers of the earth draining an area 682,000 square miles in extent or about one-fifth of the total area of Canada. More than one-third of its basin is still a "terra incognita" to the white man and is known only to a few small roving bands of Indians of the great Chipewyan stock. This in spite of the fact that it is 125 years since it was first descended to its mouth by that noted explorer, Alexander Mackenzie. It is, however, recently beginning to attract some attention in the commercial world among men who are willing to exploit its natural resources. The agricultural portion, namely, that within the basins of the Peace and Athabaska Rivers, has been widely advertised as "The Last West" and is being gradually opened up and settled. This portion of the Mackenzie Basin, together with that immediately to the north of it as far as the Liard River and Great Slave Lake, contains the largest area of unoccupied agricultural land in Canada and is the direction in which Canadian agricultural expansion is bound to take place. The remainder of the basin to the north and east is still largely unexplored and while never likely to support a large agricultural population offers a vast field of possibly great value to the prospector. What this portion of the basin contains in mineral resources it is impossible to say and unsafe to hazard a guess in view of the surprises we have already received in opening up similar country in Northern Ontario. It is satisfactory to note that the Canadian Geological Survey is now embarking on a scheme for the exploration of the vast tracts of unknown territory in this and adjoining portions of Northern Canada.

The Mackenzie River carries to the Arctic Ocean the drainage of 682,000 square miles of the northwestern portion of Canada. Its basin includes the northern parts of the provinces of British Columbia, Alberta, and Saskatchewan, and the western part of the Northwest Territories, covering from north to south about 16 degrees of latitude, from 53° to 69°. All the varieties of great land forms of mountain, plain, and plateau are included within its boundaries.

The basin of the Mackenzie river comprises three main physiographic provinces. On the west is the great series of parallel mountain ranges known as the Rocky Mountain system, rising more or less abruptly to heights which in the south often attain 10,000 feet and on Mt. Robson reach 13,000 ft., but in the extreme north rarely exceed 5,000 ft. Many of the stronger tributaries of the Mackenzie cut deeply into these ranges and some, indeed, such as the Liard and Peace, cut right through them, drawing some of their water from the western or back slopes of the ranges. The eastern boundary of this mountain region is fairly definite though not a direct line. Starting from a point about the intersection of latitude 53° and longitude 116° the line runs northwestward crossing the Peace River about Hudson's Hope and striking the Liard River near longitude 125°. Here there is a great bay in the mountains and their continuity is interrupted by the Liard river which cuts directly through them. Under the name of Mackenzie mountains they spring up again, however, immediately north of that river, but their eastern front has now been stepped far to the

eastward and abuts on the Liard river at Fort Liard as if they had been displaced by a great fault along the valley of Liard river. From here the line runs northward touching the Mackenzie river at the mouth of Nahanni river and continuing thence along the western side of Mackenzie river to latitude 65° 30', where it turns in a broad curve and sweeps westward around the head waters of Peel river. The Mackenzie mountains which are one of the largest blocks of the whole Rocky Mountain system die out in this region but another, lower, range springs up north of Peel river and extends down to the Arctic coast, its eastern front following closely the valley of Peel river and rising as an abrupt fault scarp out of the delta of Mackenzie river.

The mountain province at nearly all points merges gradually by a decrease of elevation and a flattening out of the surface into the lowland province which occupies the central portion of the Mackenzie Basin. This province is a broad northward sloping lowland through which the Mackenzie flows gently to the Arctic. It is a country of lakes and muskegs and of meandering streams flowing in moderately shallow valleys. The evenness of its surface is only broken here and there by a few rounded wooded hills or ranges such as the Cariboo mountains north of Fort Vermilion, the Horn mountains west of Fort Simpson, and an unnamed range of hills which lies east of the Mackenzie from Fort Wrigley to Great Bear river.

The Mackenzie lowland is the northward extension of the Great Plains region of the central part of the North American continent. It occupies a position in the north similar to that to the south through which the Mississippi flows southward to the Gulf of Mexico. In contrast to the Mississippi region, however, the Mackenzie lowland is forested to its mouth and it embraces within its limits three of the largest lakes on the continent.

The eastern province of the Mackenzie Basin is part of the great Laurentian plateau which occupies such a large part of northern and eastern Canada and almost completely encircles the great inland sea of Hudson Bay. The western boundary of this region is not sharply defined topographically but it coincides with the eastern border of the Paleozoic rocks which underlie the lowland region. It is a country of numerous lakes and of rivers flowing in ill-defined and shallow valleys. On a broad view its surface is level or rolling but in detail it is rugged, broken and rocky with little or no surface veneer of soil or loose material to cover the inequalities of the bed-rock. Its northern portion is treeless and is known as the Barren Lands.

The physical features of the Mackenzie Basin then are these: A mountainous highland on the west; a low-lying, rugged, rocky and partly treeless plateau on the east; and in the middle a broad, almost level, forested lowland with the trunk stream like a great artery flowing northward to the Arctic sea, fed on one hand from the melting snows of the mountains and on the other hand from the numberless lakes of the plateau region on the east.

The Mackenzie ranks as one of the eight great rivers of the earth. Its length is reckoned at about 2,800

*Extracts from an article published in Science Conspicuous,

Boston, 1915.

miles to the head of Peace River and its volume has been estimated to be about half a million cubic feet per second. It is exceeded on this continent only by the Mississippi in length, volume and drainage area, but it is greater in length and drainage area than the St. Lawrence.

It is a magnificent natural waterway allowing steamers of five feet draft to ascend without interruption from the Arctic Ocean 1,400 miles to the rapids on Slave river at Fort Smith. Above this it is navigable again for lighter draft steamers on the Peace and Athabaska rivers for a total length of about 1,500 miles in three sections. Including its great lakes and those tributary streams which have already been explored it has a total length of navigable river and lake shore line of nearly 7,000 miles, interrupted, however, at three points, namely, the sixteen miles of rapids on Slave river at Fort Smith, the rapids and falls on Peace river below Vermilion, one mile in length, and the ninety miles of rapids on Athabaska river above Fort McMurray.

The following table presents the details of these navigable waterways, the distances being in round numbers:

Navigable Waters of Mackenzie Basin.		Miles
Lower Mackenzie river section—		
Mackenzie river, below Great Slave lake..	1,000	
Peel river, to mouth of Wind river	250	
Great Bear river	90	
Shore line, Great Bear lake	1,360	
Liard river	440	
Shore line, Great Slave lake	1,440	
Slave river, Great Slave lake to Fort Smith	200	
Total.....	4,780	
Athabaska Lake section—		
Slave river, Athabaska lake to Smith Land- ing.....	100	
Peace river, Slave river to Vermilion Falls	220	
Shore line, Athabaska lake	560	
Athabaska river, Athabaska lake to Mc- Murray.....	170	
Clearwater river	80	
Total.....	1,130	
Peace river section—		
Peace river, Hudson's Hope to Vermilion Falls.....	550	
Athabaska river section—		
Athabaska river, Grand Rapids to McLeod River.....	325	
Lesser Slave river and lake	115	
Total.....	440	
Total for whole Mackenzie Basin.....	6,900	

Steamers ply on all four sections of the waterways of the Mackenzie Basin, but, as they are operated solely for the benefit of the fur-trading companies and the missions, they merely follow the main routes, which are the Peace, Athabaska and Mackenzie rivers. Some of these steamers are equipped with passenger accommodation and it is possible for travelers to make the journey in comfort from the end of the railway line at Athabaska to the head of the delta and return by securing a passage from one of the fur-trading companies.

The season of navigation extends over about four months and in the southern portion of the region, namely, on the Peace and Athabaska rivers, it is somewhat longer.

These waterways are destined to become more and more important as settlement and development of the country advance because, as they have been in the past so will they continue to be in the future the main highways on which the commerce of the country must be carried. Railways will supersede them to a certain extent, but only in the southern half of the region will they be likely to do so where the population will be mainly a farming population. Farther north where no industries are likely to develop that require a large resident population the waterways will continue to be the lines of trade and transportation for years to come.

The natural resources of the Mackenzie river region include minerals, furs, timber, game and fish, and agricultural land.

To appreciate its possibilities in mineral wealth it is necessary to have some idea of the rock formations which comprise the geology of the region.

The eastern portion of the basin is covered by very ancient rocks of pre-Cambrian age. In this region are large bodies of granite or gneiss that have been intruded into older sediments and volcanic rocks of Keewatin and Huronian age of which only remnants are now left here and there in the granite batholiths. On this complex of igneous and sedimentary rocks rest patches of what are probably Keweenawan rocks.

The mountains on the western border of the basin are built up mainly of Paleozoic sediments which have been thrown by compression into a series of parallel ranges striking in a general northwesterly direction.

The lowland portion in the centre consists of flat-lying or gently undulating beds of limestones and shales of Devonian age, which are covered in the southern portion of the basin by a thick sheet of Cretaceous sandstones and shales. Patches of Cretaceous rocks and smaller areas of Tertiary also rest on the Devonian floor in several places in the northern part of the basin.

The pre-Cambrian rocks of the east are known to contain iron, copper, nickel, and gold, but little is known of them beyond their actual occurrence in place and in no case has there been as yet any production of these metals. Iron ore occurs on the islands both of Great Bear and Great Slave lakes. Copper ore is known at several points, but probably the most important locality is to the north and east of Great Bear lake where it occurs in the native state in rocks similar to those on the south shore of Lake Superior. Evidences of nickel occurring under conditions similar to those at Sudbury, Ontario, have recently been discovered at the east end of Athabaska lake. Gold ores are known in several places in quartz veins in the older pre-Cambrian sediments where they are cut by the Laurentian batholiths.

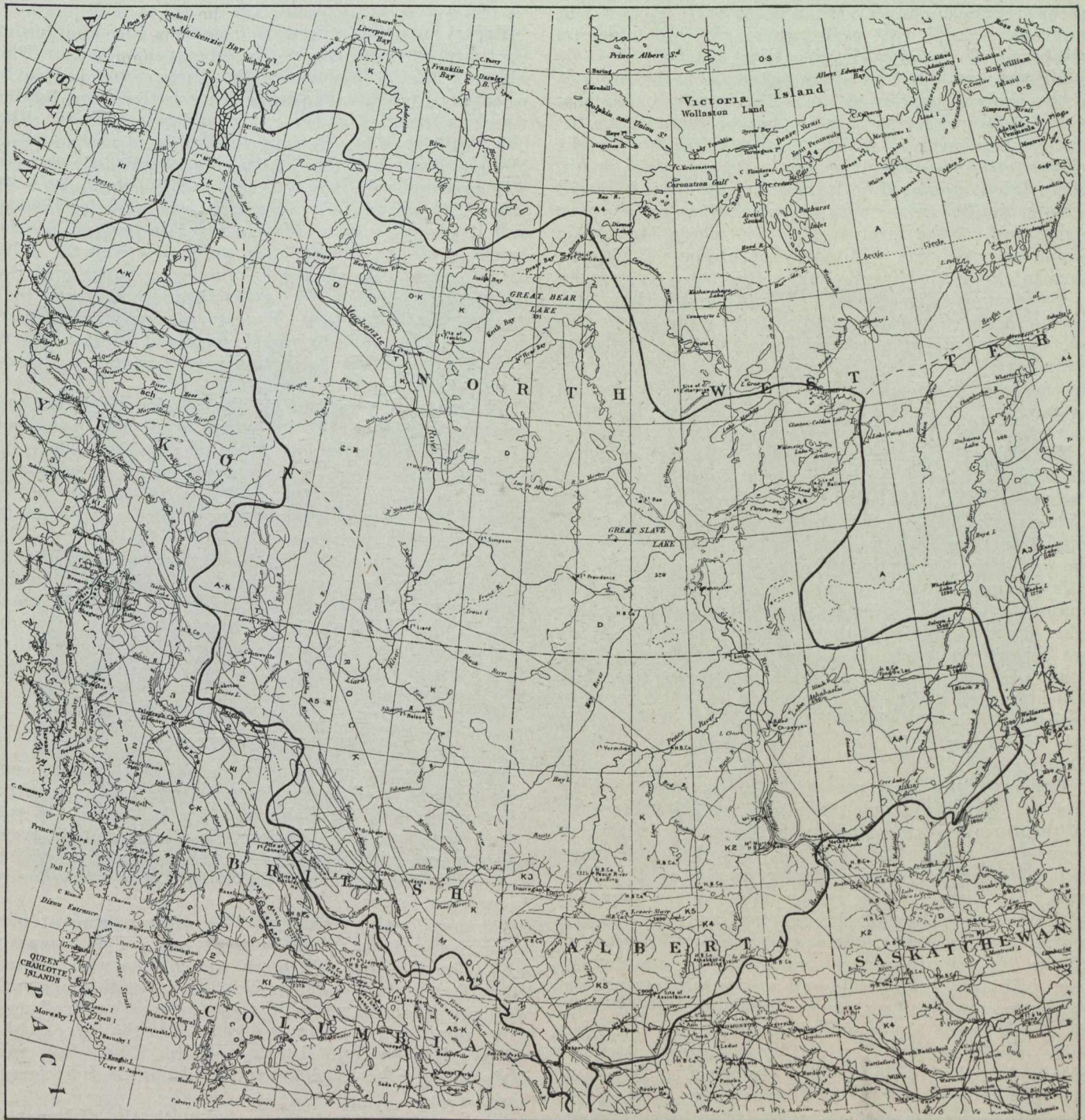
The pre-Cambrian of the eastern part of the Mackenzie Basin and of the region eastward to Hudson Bay is still virtually unexplored and these rocks comprise the largest area of unprospected ground on the North American continent. Elsewhere rocks of this age and character contain some of the greatest copper, iron, nickel, silver and gold mines of the world and it is not unreasonable to suppose that similar deposits will be found in this vast northern region.

The mountainous, western portion of the Mackenzie Basin, because it is made up mainly of sedimentary

rocks, has not the variety of metallic minerals that are found in the east. Coal occurs at several points on the eastern edge of this portion of the basin in rocks of Cretaceous age, and beds of salt and gypsum in some of the older rocks. Where, however, such tributaries of the Mackenzie as the Peace and Liard cut far enough

great, but of considerable importance, may yet be found. Of this there is already some evidence.

The lowland portion of the basin because of its being underlain by almost undisturbed rocks of a sedimentary nature is not likely to be rich in metallic minerals. It does, however, contain such non-metallic minerals



The Mackenzie River Region

back into the heart of the ranges to reach a region in which igneous intrusion has been active there again evidences are found of gold, silver, copper and lead ores. The Omenica district of the Peace river and the Cassiar district of the upper Liard have each produced placer gold amounting to several million dollars. and it is quite possible that in the great unprospected region north of the Liard river gold fields, if not as

as coal, salt, gypsum, oil and gas, and the metallic minerals, lead and zinc.

Coal occurs in abundance in the Cretaceous rocks of the Athabaska, Peace, and Nelson rivers, and to a less extent in the Tertiary. Two of the Tertiary coal fields, namely, one at the mouth of Great Bear river and another on Peel river, are on fire and have been burning at least since Alexander Mackenzie descended the river

in 1789. The fire is probably due to natural causes in spite of the Indian story that it was started by a legendary hero of theirs in order to cook his dinner of beaver.

Salt and gypsum are associated together at a number of points in Devonian rocks. Brine springs situated west of Fort Smith are the source of all the salt used in that northern country, while other brine springs and outcrops of rock salt occur at several other points, notably in the neighborhood of Fort Norman.

Oil and gas.—The most important mineral product of the lowland portion of the basin, however, and possibly of the whole of this portion of Canada are oil and gas, evidences of which are found from the height of land on the south to the Arctic Ocean on the north. The original source of both these substances is believed to be in the Devonian rocks and since these rocks cover about half of the total area of the whole Mackenzie Basin the possibility of discovering oil pools of importance in this region is excellent. Gas has been proven in great quantity by several drill holes, but little intelligent effort has so far been directed to the search for oil. Some drilling has been done on the Athabaska river but sites for the drill holes have more often been determined by the suitability of the ground for camps rather than by a study of the rock structure. The result has consequently been disappointing.

The fisheries of the great lakes of the Mackenzie, namely, those of Athabaska, Great Slave, and Great Bear lakes, are among the most valuable of the assets of the region. Whitefish and lake trout are the principal fishes, and although fish is the principal food of the majority of the population and hundreds of thousands of pounds weight are consumed annually, this amount is so small in proportion to the quantity these lakes must contain that there is no evidence that they are being exhausted. Fisheries are made annually on Athabaska and Great Slave lakes, but Great Bear lake which contains the finest quality and the greatest variety of fishes, is virtually untouched. Whitefish in this lake go up to 12 lbs. in weight, and trout to 50 or 60 pounds.

The fur trade is at present the most important industry in the Mackenzie Basin and with the exception of the farming and ranching communities in the extreme southwest of the basin virtually the whole population is more or less directly interested on this business. The history of the region is intimately bound up with the operations of the fur traders; and the few scattered settlements that are situated at intervals of 100 to 200 miles along the valley of the main rivers were originally established and are still maintained for the purpose of trading furs with the natives. Nearly all the different kinds of high grade furs such as fox, sable, mink, marten, ermine, lynx, beaver, otter are obtained in the region, and the Hudson Bay Company, probably the greatest fur-trading company in the world obtains the greater part of its furs from here. Canada exports over five million dollars' worth of furs annually, and of this amount the Mackenzie Basin supplies probably one-third.

Of the agricultural possibilities of the region few people yet have any idea whatever, though the public is beginning to awake to the value of the land within the basins of the Peace and Athabaska rivers, and railway lines are being built into this region with the object of settling it up. There is also a vast area north of the Peace river as far as Great Slave lake and the Liard river of which we know little, though sufficient to prove that it is suitable for agricultural purposes.

Altogether there is in this southwestern portion of the Mackenzie Basin an area of about 200,000 square miles suitable for settlement and there are no climate or other reasons why a self-supporting population amounting to some millions may not live and thrive there on the products of agriculture. This whole region more than any other is the direction in which Canadian expansion in agricultural pursuits is bound to take place.

Forest products might be mentioned as another of the natural resources of the Mackenzie Basin. The whole of the basin down to the Arctic coast is thickly wooded with the exception of the northeastern border which is included in the so-called Barren Lands. The principal trees are spruce, tamarack, banksian pine, birch, and poplar. One of the uses to which these trees will eventually be put will be for the manufacture of pulp. The spruce, however, is a useful tree for lumber and it grows to sizes suitable for this purpose on the banks of all the streams even as far north as the delta of the river. Large areas have been burnt and the timber destroyed by the natives because they say that it improves the hunting. Forestry protection, however, is being undertaken by the Government and the effects of this are already noticeable in the decreasing number of forest fires.

The natural resources of the Mackenzie Basin are sufficient evidence that its future is assured, for there are no difficulties, climatic or topographic, such as to prevent men of means and enterprise from entering and remaining in the country to develop these natural resources. Settlement of course must begin at the south and progress northward until the limit is reached. The northern limit for the settlement of an agricultural population in any great numbers will probably be about latitude 62° north, but there are no doubt numbers of chances for mining communities to spring up north of this and in the less hospitable country that forms the rocky region along the eastern edge of the Mackenzie Basin.

CALUMET & HECLA.

Between eight and nine thousand men will be immediately affected by the increase in wages announced for employees of the Calumet & Hecla Mining Co. and allied corporations. Ultimately, however, a great many more will benefit as practically every mining and milling company in the Lake camp is gradually increasing forces.

Tamarack which has but 150 men working at present, resumed operations a week ago. This company will take on about 400 more men in the near future. Ahmeek will reopen shafts No. 3 and 4 within a month or six weeks and will add two to three hundred men to its mining forces and probably 50 to the force at the mills. Osceola, Isle Royale, White Pine, Hancock, Quincy and other companies are adding to their forces right along.

The companies not associated with the Calumet & Hecla are expected shortly to announce wage increases restoring the scale in effect prior to Sept. 1, 1914.

Employees of the several companies announcing increases for May 1 are as follows: Calumet & Hecla, 5000; Lake Milling Co., 130; Lake Superior Smelting Co., 150; Ahmeek, 500; Allouez, 300; Isle Royale, 650; Centennial, 150; Osceola Consolidated, 1,200; Superior, 150; Tamarack, 150.

The salaried men connected with the Calumet & Hecla and allied companies, whose wages were reduced 15 per cent. last fall, were restored to the old scale March 1.

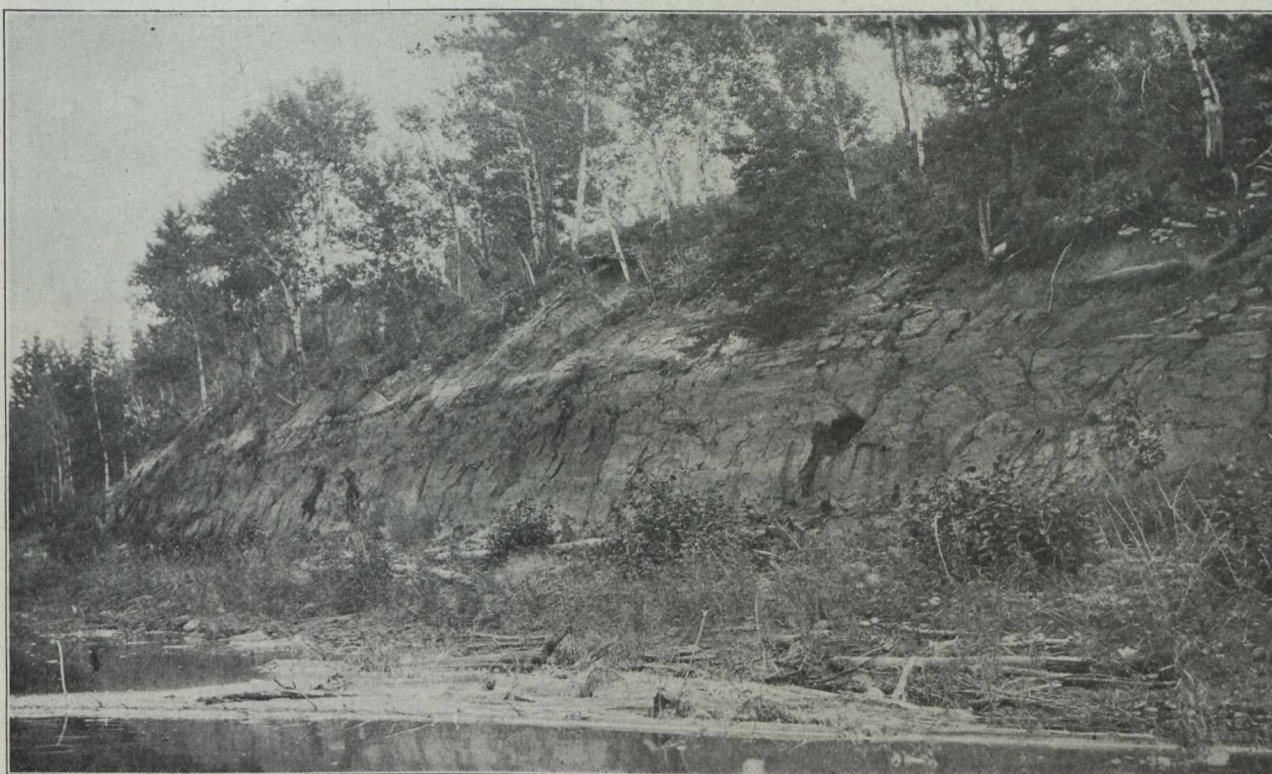
BITUMINOUS SANDS OF NORTHERN ALBERTA*

By S. C. Ells.

While much of the areal geology of northern Alberta is known, there is, at the present time, very little definite information available, official or otherwise, with regard to the extent and actual value of the mineral resources of this area. But notwithstanding the lack of detailed exploration and prospecting—which has been discouraged in the past, because of the absence of adequate transportation facilities—the occurrence of deposits of bituminous sands and sandstones has long been recognized. And when, in the near future, the proposed Alberta and Great Waterways railway is completed, it is fully expected that the

portion of the area underlain by bituminous sands cannot be considered as of any present economic value. Although the area represented by actual outcrops has not been accurately determined, it is probably not less than 750 square miles. Extensions of the deposit under heavy cover, particularly toward the south, will greatly increase this estimated area.

In the McMurray district, there is thus a very large body of bituminous sand, the prospecting and development of which will be confined to stream valleys. The following constitutes a summary of the outcrops noted by the writer:—



Exposure on east side Athabaska river, half mile below mouth of Pierre au Calumet. This illustrates a bed of bituminous sand under light overburden.

greatest hindrance to the development of the mineral and other natural resources of the region, will be removed.

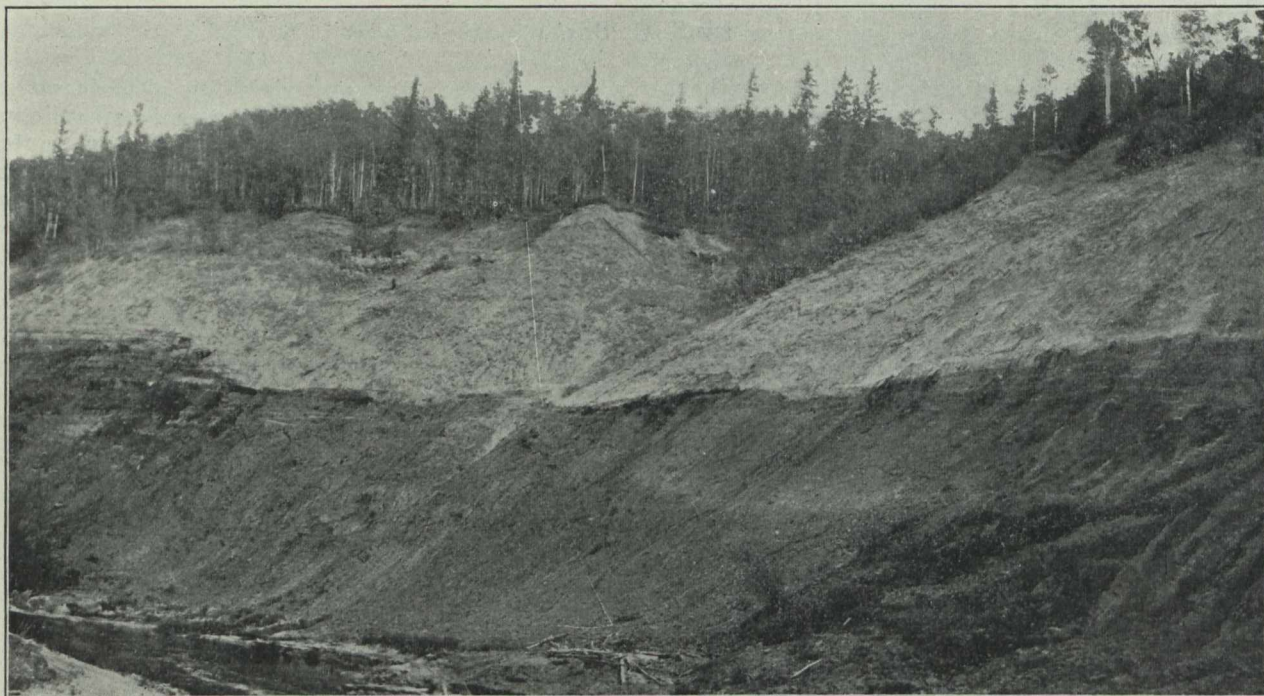
At the present time the commercial value of certain classes of bituminous sands and sandstones depends altogether upon their use in a more or less crude condition, in the construction and surfacing of certain classes of roads and pavements. The possible commercial extraction of the included bitumen, and the question of the possible derivation of by-products will not, therefore, be discussed in the present paper.

The bituminous sands of Alberta, heretofore commonly referred to as "tar sands," outcrop at a large number of points along the Athabaska river and its tributaries, for many miles to the north and south of McMurray. Certain of these outcrops represent portions of the deposit that should prove to be commercially valuable, but it is also true that a very large

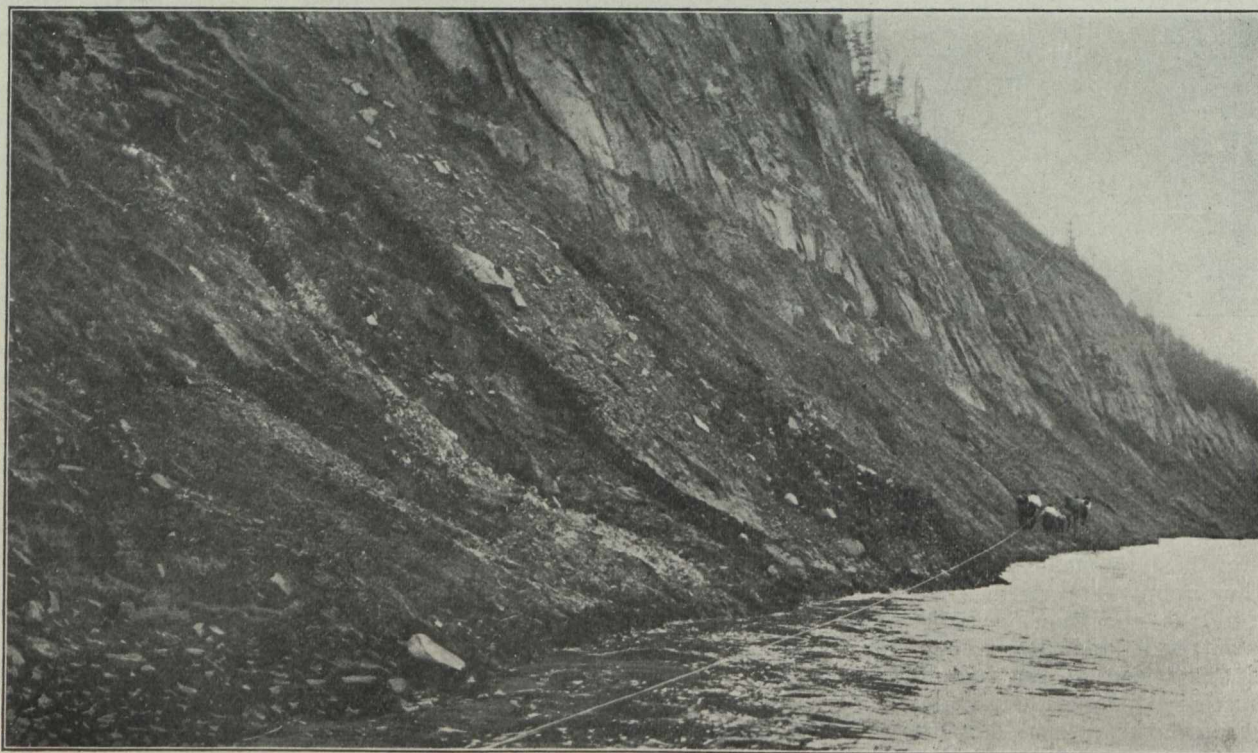
Name of stream.	Distance through which exposures recur miles	Number of separate outcrops noted.
Athabaska river	105	55
Horse creek	6	32
Hangingstone river	6	11
Clearwater river	1	1
Christina river	9	31
Steepbank river	13	35
Muskeg river	7	4
Calumet river	3	8
Tar river	6	7
Moose river	13	25
McKay (Red) river	16	38
	185	247

Only after careful exploration by means of adequate equipment can the true value of any deposit be affirmed. Nevertheless, owing to heavy overburden and lack of

*Extracts from a report published by the Mines Branch, Ottawa.



Typical exposure of bituminous sand in north bank of Horse creek, three-quarters of a mile from the mouth. Approximate thickness bituminous sand 90 feet; thickness of overburden, 400 feet from edge of creek, is 120 feet.



Exposure on east side Athabaska river, just below Mountain rapids. Although the bituminous sand here attains a thickness of over 150 feet, the overburden is very heavy.



Exposure on north side of Steepbank river, three and one-third miles from mouth, illustrating typical massive structure and cleavage of many of the high grade deposits of bituminous sand.



Exposure on east side Athabaska river at Crooked rapids, illustrating the angular cleavage and weathering typical of lower grade deposits of bituminous sand-rock.

uniformity in the quality of bituminous sand, it is probable that quite 80 per cent. of the exposures may be eliminated from further consideration at the present time. Considerations affecting transportation will still further reduce the remaining number. Certain of the outcrops should, however, lend themselves to development on a commercial scale.

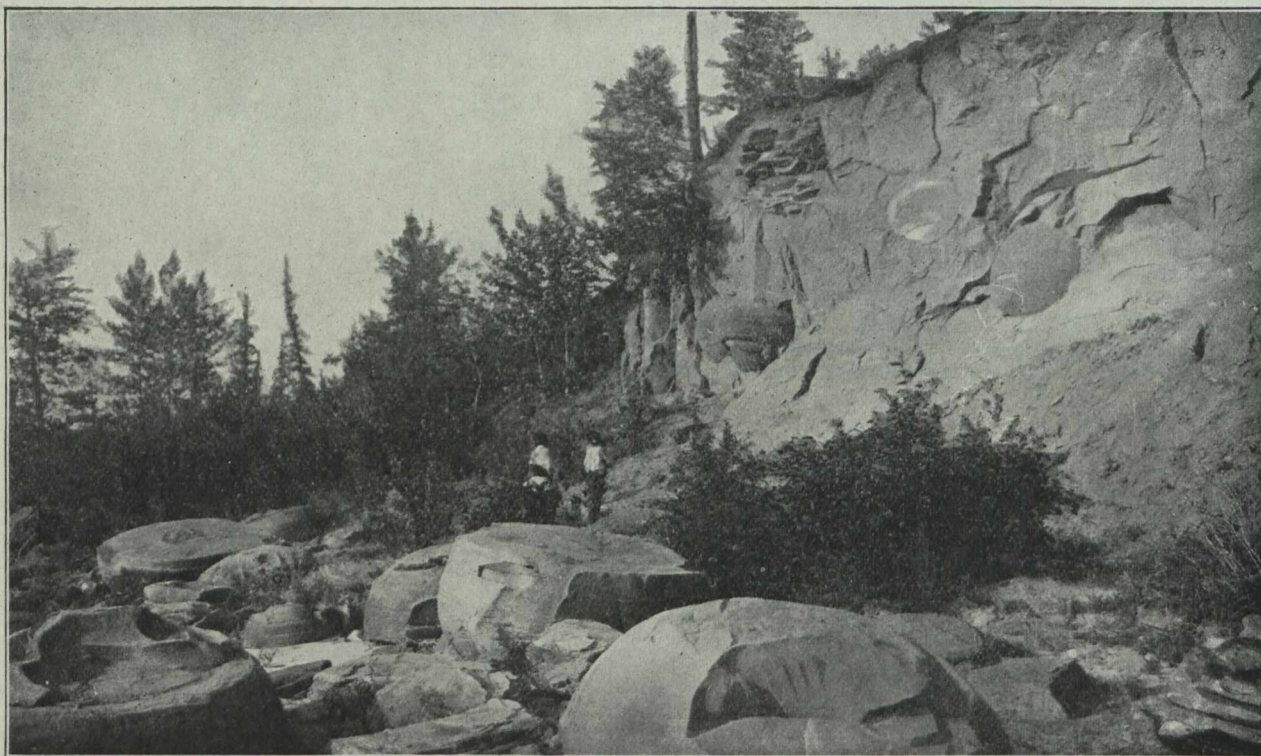
The present application of bituminous sand-rock is limited to its use as a paving material. The value of the Alberta product for such a purpose can best be demonstrated by actual experimental paving construction. Meanwhile it appears that if the development of the Alberta deposits of bituminous sand is possible, success will largely depend on making no false move in the first place, and in having no "lost motions" in operating the quarry itself.

A process that can be successfully adapted to an efficient commercial extraction of the bitumen from the

from this consideration, political interests and the somewhat questionable methods peculiar to the asphalt paving industry itself, should also be borne in mind.

From personal observation in various cities and towns in the United States, the writer believes that pavements constructed largely from bituminous sands have been satisfactory. Certain of these pavements have been subjected merely to the comparatively light traffic of residential streets, while others have been tested under severe traffic conditions. On the other hand, many pavements laid with bituminous sand have proved unsatisfactory.

From a consideration of the successes and the failures that have resulted from the use of bituminous sand rock, the writer would, in the strongest possible manner, emphasize one conclusion. It is, that the most careful study should be given to its chemical, but more especially to its physical, character, as a preliminary step to



Typical exposure Grand Rapids sandstone, at Grand rapids, Athabaska river, showing spherical concretions.

sand aggregate, would prove of very considerable value in any attempts that may be made to utilize these deposits of bituminous sand. After considering the many attempts at such extraction that have been made during the past twenty years, the writer does not know of any instance where the outcome has proved a commercial success. It appears, however, that under favorable conditions the development of a successful extraction process may be possible.

Meanwhile, the discovery of petroleum fields in western Canada will have a direct bearing on any proposed development of the Alberta deposits of bituminous sand.

Bituminous sands have, for a number of years, been used in the construction of various classes of pavements in the United States. The principal sources of supply at the present time are in Kentucky, Oklahoma, and California. The extent to which the material has been used, appears to have been determined to a considerable degree by the fixing of freight charges. Apart

actual attempts at paving. To handle our Canadian bituminous sand in a haphazard manner, either through failure to intelligently appreciate its true nature, or through lack of proper manipulation, will simply be to court failure and serious financial loss. The writer considers that the construction of one or more types of experimental pavement, will prove to be the most satisfactory method of actually determining the real value that should attach to bituminous sand from the Alberta deposits.

Advices from Seattle, Washington, state that ten employees of the Alaska Engineering Commission left that point on April 14 for Ship Creek, Cook Inlet, to start activities on the Alaskan Government Railway. A large quantity of supplies was sent with party and will be followed by further shipments. Another party of 45 men will follow the advance contingent on the next steamer for the north from Seattle. Heavy machinery and construction parties will be despatched later.

METALLURGICAL PRACTICE IN THE WITWATERSRAND DISTRICT, SOUTH AFRICA*

By F. L. Bosqui, Johannesburg, Transvaal.

The history of the development of gold metallurgy in South Africa is divisible into two periods: That preceding the introduction of the cyanide process on a commercial scale in 1890; and the 24 years intervening between that important event and the present time.

The period between the discovery of the banket reefs of the Witwatersrand and the year 1890 was one of phenomenally rapid progress in mining development, but of no special interest to the metallurgist. There were no strikingly original or distinctly local advances in the treatment of gold ores. Californian practice in stamp milling and amalgamation prevailed, in mills ranging in equipment between 5 and 50 stamps, operating within a wide range of efficiency, and under the trying conditions usually encountered in a new and isolated field.

Assuming that the recovery at that time was as high as 60 per cent., the recoverable gold lost in tailing from the ore treated during this first period, in spite of the precaution taken in some instances to impound this product, must have been very considerable. It is evident, therefore, in view of the colossal strides made by the industry at this stage, and the promise revealed for the future, that the advent of the cyanide process was most opportune.

The introduction of the cyanide process was the direct result of trials conducted at the old Salisbury battery in 1890 by the Cassel Gold Extraction Co., of Glasgow, which controlled the MacArthur and Forrest patent rights. Its first application on a commercial scale was in the same year, in the treatment, by contract with the Gold Recovery Syndicate, of 10,000 tons of tailing on the Robinson Gold Mining Co.'s property, under the direction of G. A. Darling. In February, 1891, W. A. Caldecott started the cyanide works at the Sheba mine in the Barberton district; and a year later, Charles Butters erected a large plant at the Robinson mine to treat all the tailing from that property. From this time cyaniding was recognized as an indispensable adjunct to every mill. It was not, however, until 1894 that the direct treatment of battery slime became a success. The first decantation slime plant was erected in this year at the Crown Reef mine, under the direction of J. R. Williams, at that time chief metallurgist for the Rand Mines, Ltd., who evolved the process after several years of practical trials.

In the meantime, in 1894, the Siemens-Halske electrolytic method of gold precipitation was introduced at the Worcester mine, and was adopted by several other properties. But in spite of able advocates it never won general acceptance, owing, broadly, to the extreme delicacy of the process, the formation of troublesome by-products, and the high degree of skill required to maintain uniform efficiency; and after exhaustive comparative trials with zinc and electrolytic deposition at the Nourse Deep mine in 1898, it was finally abandoned in favor of zinc. Fortunately, a serious objection to zinc precipitation—namely, the difficulty of precipitating from the very dilute cyanide solutions used in slime treatment—was partly overcome at about this time by the use of acetate of lead as a "dip" for zinc shavings, which coated the zinc with

metallic lead, forming a zinc-lead couple which greatly promoted galvanic action in the zinc boxes.

With the reversion to the use of zinc, Rand metallurgical practice may be said to have crystallized into a general scheme of milling and of separate sand and slime treatment by cyanide, which came to be looked upon as typically South African, having been, with the exception of stamp milling, evolved by local chemists and metallurgists. Even the introduction of tube mills in 1904 did not seriously modify the main features of the system. The tube mill became simply an accessory to the stamp. This survival of the broad principles of ore treatment, as developed by the clever metallurgists whose services the industry was fortunate enough to secure at the beginning, has been attributed to a narrow disinclination to adopt new methods as applied in other parts of the world. This view, however, must be very considerably modified.

The tube mill and vacuum filter.—It is true that the metallurgists of the Rand were slow to accept the two most notable appliances introduced into the treatment of gold ores in the last 10 years—the tube mill and the vacuum filter. The former was introduced in Africa in 1904, after having been for some time a success in Australia; the latter in 1909, after four years of brilliant success in America and elsewhere. The Boer war undoubtedly retarded the introduction of tube milling, and it must be admitted that when once tried, and their merits proved, both innovations were very generally and enthusiastically adopted. The fact that such radical measures as "all sliming," dry crushing, and numerous schemes for continuous treatment of battery pulp by agitation have not found favor on the Rand is evidence, not of lack of enterprise or open-mindedness, but of the proper estimation of unique local conditions, and the conviction that any system of treating the low-grade Rand ores must fulfill the essential requirements of "foolproof" simplicity in operation, low maintenance and treatment cost, and high efficiency.

Sorting and Breaking Ore.

Ore sorting on the Rand has been the subject of a good deal of discussion. It has been suggested that all sorting should be done underground, while authorities have differed as to what proportion should be done underground and what on the surface. A kind of crude preliminary sorting is now done below the surface, consisting in hand breaking of pieces of ore too large for convenient handling. Obviously, the technique of ore sorting is a matter to be dealt with independently on each mine. The present practice is to sort above ground, at a central sorting and breaking station, where both operations are usually carried on under the same roof. These stations are of great variety, but the general principle is the same in all.

The ore, on reaching the surface, is divided into two products by means of grizzlies, which take it direct from the skips in the headgear; the "fines," which it is impossible to sort economically, go direct to the mill bin; the coarser product is then delivered either (1) to grizzlies or (2) to trommels, where it is washed and screened preparatory to hand sorting. Or, in older

*Extracts from a paper to be presented at the San Francisco Meeting, American Institute of Mining Engineers, September, 1915.

plants, the grizzly and trommel are omitted, and washing is done by means of sprays on the same belt or table on which sorting is performed. Washing the ore is necessary in order to enable sorters to distinguish between banket (conglomerate ore) and waste. It is now recognized that this operation cannot be thoroughly performed except in washing and screening trommels, and the latest plants are all equipped with this device. From the trommel or grizzly the washed ore is delivered to either a revolving table or a traveling belt.

The advantage of the sorting table is that it permits of a compact plant, and so simplifies supervision; but the belt has now almost entirely superseded the table, its advantages being that it is cheaper to install and operate and that it elevates and conveys the ore as well as provides a sorting surface.

The sorted ore is delivered to breakers, of which there are two types in common use, the Blake-Marsden jaw type with its variations, and the gyratory type, of which the Gates is generally used. The gyratory breaker is the type now accepted by the Rand Mines and Consolidated Goldfields groups, and is considered more efficient and cheaper to operate where large tonnages are handled; the jaw crusher, however, is a simpler machine, of relatively less weight and requires less vertical height. The gyratory crusher is particularly well adapted to the finer breaking, while for coarse preliminary breaking, before sorting, where the production of fines is objectionable, the jaw type is preferred.

There is still a divergence of opinion as to the extent to which breaking before sorting should be carried. In some mines breakers are placed underground, with the jaws set to 4 to 8 in. opening, to reduce the ore to suitable size for handling in the skips and for sorting; more often these breakers adjoin the headgear. Where they are omitted altogether, it is in recognition of the theory that it is better to send a high percentage of waste to the mill than reduce the waste to smaller pieces, and so improve the accuracy of sorting while increasing the aggregate gold content of the waste dump. It will be seen from the foregoing that the practice in dealing with the ore before it goes to the mill is exceedingly variable. Within the last four or five years, however, the technique of sorting and breaking has greatly improved, and there is now apparent, among the groups erecting new plants a disposition to collaborate in an effort to bring about more uniformity in practice and mechanical arrangement.

Stamp Milling.

The gravitation stamp has retained its place on the Rand as the simplest and most effective appliance for crushing ore. Until the recent introduction of the heavy single-stamp unit, the general features of ore crushing have undergone no very radical change since the introduction of Californian mill practice over 20 years ago. The most marked departure from the typical 900-lb. stamp of those days is in the progressive increase of weight. This interesting evolution from the light to the heavy stamp has probably now reached its limits in the adoption of 2,000-lb. stamps in mills erected within the last few years. Changes in detail of battery construction have been necessitated by this progressive change in weight; exigencies of high stamp duty, requiring larger bin capacity, have also brought about modifications in constructional detail.

It would be impossible in the scope of this paper to deal with the many variations in stamp-battery construction to be found on the Rand. I shall consider

only a few of the more important stages in progress, which have led to the introduction from America of the single-stamp unit, or Nissen stamp.

The first step in advance was the adoption by the Robinson Gold Mining Co. and others of 1,250-lb. stamps. This was the maximum until 1907, when a distinct impetus was given to a consideration of heavy stamps by the results of a series of trials conducted by the Consolidated Goldfields group under the direction of W. A. Caldecott. It was obviously desirable to ascertain the highest duty attainable from as heavy a dropping weight as could be sustained by an improved type of mortar box and concrete mortar block. It was apparent that an increase of duty would mean a corresponding decrease in number of units necessary, and, in consequence, lower initial and operating cost.

The Goldfields trials led to the installation of three large batteries of 1,550-lb. stamps, and more recent mills have adopted heavier weights up to 2,000 lb. Gradually timber-pile foundations were abandoned in favor of reinforced concrete, with or without the interposed anvil block. The stem and cam-shaft breakage attributed to this cast-iron base, and the higher cost of batteries using the anvil block, led to its abandonment in most of the more recent mills, although it still has its advocates. The accepted practice is now to bolt the mortar box direct to the concrete block by means of renewable bolts so arranged that they can be tightened while the battery is in operation. A cushion of hair felt or of sheet rubber, about $\frac{3}{8}$ in. thick, is placed under the mortar box.

A notable departure from the standard type of battery construction was the case of the City Deep, Ltd., which in 1909 adopted reinforced concrete piers instead of king posts, and separate bearings between the cams, for a new battery of 2,000-lb. stamps. This design was intended to obviate cam-shaft breakage by affording greater bearing surface, and to insure better alignment, in view of the greater strain imposed upon the cam shafts by the heavy stamps. At the City Deep the concrete piers built up from the 10-stamp block support a single rigid steel casting, into which all the various parts of the usual battery superstructure are consolidated. The main feature of this casting is the heavy fish-bellied girders, with eight upward projections or fingers, terminating in cup-shaped bearings for the cam-shaft. Each 10-stamp shaft is thus given eleven bearings instead of the three usually provided. Theoretically, the innovation was sound, and ingeniously worked out. In practice, however, complications developed. It was found that a true alignment of bearing surface was practically impossible to maintain, without most troublesome and constant adjustment of the bearings themselves. Moreover, as the advantages of such a design were obviously dependent upon the integrity of the single ponderous casting, it was expected that this rigid frame would resist the enormous strain of continuous vibration. Unfortunately this casting in the course of time weakened, and developed fractures, requiring reinforcement and patching.

Following the City Deep installation, the old standard design of battery was reverted to and has been, with one exception, retained. In mills erected within the last five years we find the weight of stamps ranging between 1,550 lb., which some authorities reckon to be the conservative limit for combination of five units in a single mortar box, and 2,000 lb., which many regard as excessive weight, from the point of view of efficiency, convenience and cost of maintenance.

(To be continued).

MINING ACCIDENTS IN ONTARIO IN 1914

According to Mr. T. F. Sutherland, Chief Inspector of Mines of Ontario, there were during the year 1914 at the mines, metallurgical works, quarries, clay pits, and gravel pits regulated by the Mining Act of Ontario 54 fatal accidents, causing the death of 58 men. Of these, 28 causing the death of 29 men, occurred underground—a decrease of 8 as compared with the preceding year. The fatal accidents took place in mines operated by 23 different companies. At metallurgical works there was a marked decrease—4 fatal accidents causing the death of 5 men as compared with 11 fatalities during 1913. The number of fatalities at quarries shows an increase—14 fatal accidents resulting in 15 men killed, as compared with 8 killed in 1913, and one in 1912. The increase noted from year to year in the number of fatalities at quarries and clay and gravel pits is due to the fact that more complete returns are now being received from such works than formerly.

The total number of serious accidents in and about the mines of Ontario reported to the Bureau of Mines in 1914 was 359; resulting in 38 deaths and injuries to 328 persons. Of these accidents 282 occurred underground and 75 above.

At metallurgical works there were 104 accidents which caused the death of five men and serious injuries to 101.

At quarries there were 30 accidents, causing the death of 15 men and serious injuries to 16. It is evident that only a small portion of the non-fatal accidents at quarries is being reported to this Department.

In accordance with the Mining Act, inquests were held on all fatal accidents and attended by one of the inspectors.

The fatal accidents occurring in the mines were divided amongst the several districts as follows:

Gold mines of Poreupine and Kirkland lake	12
Silver mines of Cobalt and adjacent districts.	11
Nickel-copper mines of Sudbury	9
Iron mines of Michipicoten	4
Iron pyrites mine, Western Ontario..	1
Mica mine, Eastern Ontario	1
<hr/>	
Total.	38

It is interesting to note that the greater number of fatalities occurred during the first six months of this year as in 1913.

January, 1915, is the first month since August, 1911, in which there has not been a fatal accident in the mining industry.

On January 1st, 1915, the amendment to the Mining Act affecting cages and skips used for carrying men came into force. It is as follows (section 164, rule 32a):

All cages and skips used for lowering or raising men shall be constructed as follows:

(a) The hood shall be made of steel plate not less than three-sixteenths of an inch in thickness;

(b) The cage shall be provided with sheet iron or steel side casing not less than one-eighth of an inch in thickness, or with a netting composed of wire not less than one-eighth of an inch in diameter, and with doors made of suitable material;

(c) The doors shall extend at least five feet above the bottom of the cage, and shall be closed when lowering or hoisting men;

(d) The cage shall have overhead bars so arranged as to give every man an easy and secure handhold;

(e) The safety appliances shall be of sufficient strength to hold the cage or skip with its maximum load at any point in the shaft.

(f) The cage shall not have chairs attached thereto which are operated by a lever through or from the door.

The necessity for a regulation of this kind is seen from the number of accidents every year due to the light open-type cage in use at many Ontario mines. Care should be taken that the gate is kept in good repair and is so constructed that it cannot open outwards, thus avoiding all possibility of catching in the shaft timbers.

On January 1st, 1915, the Workmen's Compensation Act came into force.

The mining industry is included in Schedule I. Industries so classified are not individually liable. The Board levies an assessment and collects an accident fund, out of which the compensation to workmen is paid.

Compensation is paid on all accidents arising out of and in course of the employment, except:

1. Where the disability lasts less than seven days.
2. Where the accident is attributable solely to the serious and wilful misconduct of the workman and does not result in death or serious disablement.

The scale of compensation is as follows:

If the accident results in death and the workman leaves a widow but no children, the widow is entitled to a monthly payment of \$20 a month.

If he leaves a widow and children the payment to the widow is \$20 a month and \$5 a month for each child under 16 years of age, not exceeding \$40 in all.

If he leaves children only, the payment is \$10 a month for each child under 16, not exceeding \$40 in all.

If the workman was under 21 years of age and his dependents are his parents or one of them, such parents or parent will be entitled to \$20 a month until the workman would have become 21 years of age, or for such longer time as the Board may determine.

In the case of other dependents they are entitled to a sum reasonable and proportionate to the pecuniary loss occasioned to them by the workman's death, as determined by the Board.

The necessary expenses of burial, not exceeding \$75, are also in all cases to be paid.

All the above is governed, however, by the provision that in no case is the compensation to exceed 55 per cent. of the workman's earnings in the employment; and all provisions for compensation are subject to the proviso that no salary or wages of a workman shall be reckoned at more than \$2,000 a year.

In the case of a widow who marries again the periodical payment ceases on her marriage, but she is entitled within a month after her marriage to a lump sum equal to two years' payments.

Where the accident results in total disability of the workman, he is entitled during the continuance of the disability, whether for life or temporarily, to a weekly or monthly payment equal to 55 per cent. of his earnings in the employment. Where the workman is only partially disabled he is entitled to 55 per cent. of the impairment of his earning capacity.

Where less than six workmen are usually employed in mining, including prospecting and development work, except in producing mines where the workmen are in the employ of the owner, lessee or recorded holder thereof, the industry is withdrawn from its class in Schedule I.

An industrial disease is considered a personal injury by accident, and a workman or his dependents is entitled to the regular scale of compensation. The most common industrial disease in mining is miners' phthisis.

Employers are required to give notice to the Board by registered mail of an accident within three days of its occurrence.

The rate assessed per \$100 of payroll in mining and associated industries is as follows:

Mining	\$3.00
Iron smelting	2.00
Concentrating, stamping or other preparations of metals or minerals (without heat) . . . . .	.80
Reduction of ores (with heat), smelting or refining of other metals or minerals	1.50
Clay and gravel pits	2.00
Quarries	2.50
Railroads	6.00
Manufacture of explosives	10.00

The Compensation Act as it now stands is criticized by mine operators in connection with the following points:

Miners' phthisis is an industrial disease which, under ordinary conditions in Ontario would result only after several years' work underground. There is nothing in the Act to prevent a miner who has contracted this disease in another country moving to Ontario and taking advantage of the compensation paid by the Ontario Act.

The Act requires that all accidents be reported within three days. As compensation is paid only for accidents which incapacitate a workman for seven days, and as the majority of mining accidents do not disable a man for this period, the reporting of such accidents entails considerable unnecessary work.

The grouping of all the mines under one classification weakens the incentive to avoid accidents. Certain mines are necessarily more unsafe to work than others, and must in the long run have a higher accident rate. Within the past three years several mining companies in Ontario have by means of safety engineers, mine inspectors or safety committees gone to considerable expense in efforts to lower their accident rate; in every case these efforts have met with signal success. Nevertheless the safe mine or the careful operator has to pay the same rate as the unsafe mine or the indifferent operator. The result has been that since the Act came into force several companies have abolished their safety departments.

"GERMANS KNOW EVERYTHING AND UNDERSTAND NOTHING."

"The Germans have at Berlin the most complete bureau of information to be found anywhere in the world. They know everything and understand nothing. They had no measurement in Germany to gauge the soul of a nation such as that of the British Empire," declared Mr. C. W. Barron, in his address before the Montreal Canadian Club.

NIPISSING.

The following is a brief financial statement of the affairs of the Nipissing Mining Co. Ltd., (the Operating Company) as of April 1st, 1915. Cash in Bank \$547,590.43; Bullion in transit \$264,057.21; Ore on hand and in process and bullion ready for shipment \$577,664.31; Total \$1,389,311.95.

DISASTER AT BRITANNIA MINES, BRITISH COLUMBIA

The loss of more than fifty lives at the Britannia Mining and Smelting Co.'s copper mines on Britannia mountain, near Howe sound, British Columbia, resulted from a slide of snow and rock which occurred soon after midnight of Sunday, March 21. On April 1 it was stated that 34 bodies had been recovered and 19 persons were reported missing. In addition, 24 persons were known to have been injured—two dangerously and about ten seriously, the others having escaped with only slight injuries. As there is still in the valley at and below the site of the old camp much snow and debris, the work of finding the remaining dead bodies is slow, and hydraulicking has been resorted to in order to facilitate operations.

The group of mineral claims on which the Britannia Co. has opened several mines is situated in the mountains of the Coast range east of Howe sound, about 20 miles directly north from Vancouver, and 28 miles by water, following the Coast line from that city. Howe sound is an irregular fiord, cutting well back into the Coast range, and is bordered along its whole length by rugged mountains and high ridges. The mine now being worked is in the steep mountain-slope covered by the company's Fairview claim. This ridge separates Britannia creek from Furry creek; it is about 4,300 ft. in height. The principal workings are in the north slope of the ridge at a distance of three and a quarter miles from the coast and at an elevation of from 3,275 to 3,775 ft. above sea-level. The Fairview mine is opened by six adits ranging from 100 to 250 ft. between levels, with connecting raises from what is known as the 1,050 ft. level, which is practically at the level of the mine camp, up to the 250 ft. or highest level. All ore from above the 1,050 ft. has been dropped down the raises to that level, and hauled thence by a 3-ton electric locomotive to the rock-crusher at the upper terminal of an aerial tramway the length of which is 5,800 ft. down to a reloading or transfer station at 1,400 ft. lower elevation, and thence 11,000 ft. to the concentrating mill at Britannia Beach near sea-level, which is about 1,900 ft. still lower.

During the last two or three years important improvements have been made with the primary object of overcoming difficulties attendant upon surface operations at the higher level of the upper camp where deep snow impedes outdoor work in winter, and of enlarging the transportation facilities. A cross-cut adit, known as the 2,200-ft. level, starting at a short distance from the intermediate station of the aerial tramway, has been driven 4,336 ft. into the mountain, and from it an 8x12 ft. rock-raise has been holed through to the 1,050 ft. level above; a three-compartment shaft, outside measurements 10x20 ft., commenced at 3,922 ft. in from the portal of the new adit, is now less than 190 ft. from the 1,050 ft. level. On completion this will be the chief connection between the old workings above and the 2,200-ft. level, and the latter will be the main outlet from the mine. Haulage thence will be by electric locomotives over the three and a half miles of sidehill railway to the head of a double-tracked incline, 5,500 ft. long, and of an average grade of approximately 30 per cent., down to the concentrating mill at 1,600 ft. lower elevation. These late improvements, however, are not yet available for mine use, so the aerial tramway will for some time longer remain

the chief means of transportation, at any rate between the transfer station and Britannia Beach.

Concerning the recent slide and its disastrous results—it appears that a great mass of snow, rock, and earth slid down from one of the mountains above the camp. It probably was started by the breaking away of part of the face of one of the big bluffs of rock, above the 1,050-ft. level of the Fairview mine, the outlet of which was the snow-shedded tramway thence to the rock-crusher at the upper terminal of the aerial tramway. Coming down at a right-angle to the narrow valley in which the camp was situated the slide turned sharply to the left and then through the camp, carrying away much of the covered tramway, the cookhouse, one bunkhouse, office, store, hospital, clubhouse, electrical shop and transformer house, crusherhouse, tramway terminal, and seven dwellings. Fortunately two bunkhouses and several dwelling houses escaped the general ruin. One end of the mine superintendent's house was broken away, and some of the rooms partly filled with snow and debris, but the family were unhurt. Then the slide turned down Jane creek and continued on to Britannia creek, stopping within 200 ft. of the outlet of the new adit forming the 2,200-ft. level. The total length of the slide has been stated in an official report to have been 4,300 ft., and the difference in altitude between its starting point and where it stopped about 1,900 ft.

The number of persons known to have been living in the upper camp two or three days before the disaster occurred was 163, this total including 137 men, 15 women, and 11 children. Of these, it seems that 77 (including some of the women and children) either lost their lives or were injured. The others were men on night-shift in the mine or asleep in one or other of the two bunkhouses that were untouched, or were in dwelling houses situated out of the pathway of the slide. Sensational newspaper stories have given grossly exaggerated details, but the officially reported facts are as above stated. At one time, prior to the outbreak of the European war, the Britannia company had fully 700 persons on its payroll, but this number included all employees at the mill and other works at Britannia Beach, all on railway and other construction work between the Beach and the new adit, those employed at the new camp at Halfway, and those engaged in development work at the new adit, as well as all in and about the mountain camp that was destroyed, but the total number of employees during recent months has been between 500 and 800.

For years the company has had at Britannia Beach its own well-equipped hospital, with resident doctor and trained nurse, and a smaller hospital at the upper camp with another doctor there. It has also paid a prominent surgeon resident in Vancouver City a regular retaining fee so as to have his services in special cases when required. During recent months it purchased three pulmotors, and only a few days before the disaster occurred a provincial government official was at the property giving instruction in the use of this modern automatic reviving apparatus.

One result of the recent fatal experience will be the hastening of the previously-decided practical abandonment of the upper camp, for now the big shaft connection between the 2,200 and 1,050 ft. levels will be completed with all expedition, the construction of the incline from the lower end of the railway down to the concentrating mill (which work is already well advanced) will be finished, and the heavy machinery (much of which is now on the ground) to be used in

connection with the crushing of ore and its delivery to the electric trains for conveyance to the head of the incline, will be put in as soon as possible, so that ore-production may be resumed and the intended enlargement of output be carried into effect. Much of this new work would have been done last autumn and winter had it not been for the partial suspension of operations necessitated by the war, and in that case there would probably have been only a comparatively small number of residents in the old mountain camp. However, no human foresight could have averted the recent calamity, of which there was no warning.

STEEL COMPANY OF CANADA.

The experience of the Steel Company of Canada during 1914 was the experience of the steel industry generally throughout the United States and Canada. It's the old, old story as put down by Andrew Carnegie: "The steel industry is either prince or pauper."

Stimulated by war orders the company looks forward to a profitable 1915 however. Mr. C. S. Wilcox, in his report prepared for the shareholders' meeting on April 29, says in this regard "Since the close of the year we have received some large orders for materials required for the British and Home Governments. These orders will keep some of our departments well employed for a number of months."

The results of the year's operations were net profits of \$539,811 after expending \$341,587 for repairs, maintenance and improvements on plant and machinery. Though the preference dividend was only paid for the first half of the year the deficit was run up to \$313,172. There was a deficit of \$85,802 before the dividend was even met. This compares with earnings at the rate of 14.7 per cent. on the preference stock in 1913 and 14 per cent. in 1912.

In his report Mr. Wilcox, the president, says: "The Conditions of trade during 1914 bore heavily on the steel companies in both Canada and the U. S., as shown by the various financial reports which have already been published. The practical cessation in all activity in railway building, in the manufacture of agricultural implements and cars of all kinds, of municipal and other construction work, etc., cut deeply into the production of rolled bars and pig iron which are our heaviest tonnage lines.

"The first five months of the year were particularly dull, but in June and the early part of July a fair increase was noticed, but at the outbreak of war business was entirely disrupted; many desirable orders which we had on our books were cancelled in whole or in part. With the falling off in demand there followed, as a natural sequence, a decline in prices.

"To meet the decrease in earnings every effort was made to reduce expenses. Both administration and operation forces were brought down as early as possible to the lowest point, consistent with the best interests of the company.

"It will be observed from our financial statement that while we have increased the amount of our reserve funds by \$53,640.18, nothing has been written off for depreciation. There was, however, a considerable sum spent in extraordinary repairs and improvements. In reducing our forces, we had to bear in mind that we could not afford to destroy our organization by laying off all skilled men. The time of these men was fully occupied in making the repairs and improvements above mentioned, with the result that all our plants are to-day in a high state of efficiency."—Financial Times.

NIPISSING MINING COMPANY, LIMITED, ANNUAL REPORT, 1914

Mr. R. B. Watson, general manager, submits the following report of operations of the Nipissing Mining Company, Ltd., for the year ending Dec. 31, 1914:

Shipments in 1914.

	Dry Tons	Fine Silver Ounces	Net Value	Per Cent. of Total Net Value
Silver Bullion, including Bullion produced from Custom Ore.....	216.5970	6,300,177.23	\$3,431,853.43	155.82
Cobalt Residue, including Residue produced from Custom Ore.....	1,060.6290	34,452.62	42,344.06	1.92
Second Grade Ore	4.9105	1,066.72	627.31	.03
Total shipments	1,282.1365	6,335,696.57	\$3,474,824.80	157.77
Less Custom Ore	847.9241	2,335,834.06	1,272,424.18	57.77
Shipments of Nipissing Product	434.2124	3,999,862.51	\$2,202,400.62	100.00%

Summary of Shipments, 1914.

Nipissing Production Only.

Dry Tons Shipped	434.2124	Received from sales of Cobalt	\$6,568.08
Gross Ounces Silver Contained	3,999,862.51	Gross Silver and Cobalt Value	\$2,221,194.68
Gross Silver Value	\$2,214,626.60	Marketing Charges	18,794.06
Average price received per ounce—cents	55.365	Net value received from sales	2,202,400.62

Production in 1914.

	Dry Tons.	Ounces Silver	Gross Value	Net Value
Shipments in 1914	434.2124	3,999,862.51	\$2,221,194.68	\$2,202,400.62
On hand at Mine, Dec. 31, 1914	206.9650	1,110,272.15	538,481.99	523,913.03
On hand at Mine, Dec. 31, 1913	641.1774	5,110,134.66	\$2,759,676.67	\$2,726,313.65
Difference between estimated shipments in 1913 and actual returns	129.4210	420,801.62	243,619.81	239,515.37
Nipissing production	511.7564	4,689,333.04	\$2,516,056.86	\$2,486,798.28
			7.99	7.99
	511.7564	4,689,333.04	\$2,516,064.85	\$2,486,806.27

Cost of Producing Silver, Nipissing Mining Co.

Based on production of 4,689,333.04 oz. and 80,037 tons milled.

	Per Ton	Per Oz.	
	Ore	Silver	
Hydraulicling.....	\$ 46,578.98	.582	\$.0099
Diamond drilling.....	3,005.00	.037	.0006
Development and exploration.....	220,799.48	2.759	.0471
Stopping.....	136,326.32	1.703	.0291
Loading and shipping.....Cr.	1,628.53	.020	.0003
Assaying and engineering.....	11,571.54	.144	.0025
Administration and office.....	27,611.09	.345	.0059
Boarding house and camp maintenance.....	20,719.94	.259	.0044
Insurance and taxes.....	37,443.67	.468	.0080
General and legal.....	23,877.10	.298	.0051
High grade mill.....	36,327.17	.454	.0077
Low grade mill.....	315,650.59	3.944	.0673
Depreciation.....	54,242.41	.678	.0116
Marketing product.....	24,894.48	.311	.0053
Corporation, New York office and traveling.....	13,692.29	.171	.0029
	\$971,111.53	\$12.133	\$.2071
Less rents and interest	42,667.84	.533	.0091
Total cost of production	\$928,443.69	\$11.600	\$.1980

Summary of Production.

Gross Value of Production	\$2,516,064.85	100.0%
Total cost of production	928,443.69	36.9%
Difference.....	\$1,587,621.16	63.1%

Total Shipments to December 31, 1914.

	Dry Weight Pounds	Gross Ounces Silver	Gross Value plus Cobalt and Arsenic paid for	Silver Net Value Received
1904.....	124,659	32.13	\$24,163.90	\$23,887.52
1905.....	939,373	753,153.90	505,638.28	471,666.61
1906.....	4,019,494	2,214,821.60	1,576,852.94	1,421,655.54
1907.....	4,804,426	2,239,551.89	1,373,088.57	1,234,492.35
1908.....	7,009,998	2,893,031.44	1,526,686.32	1,364,478.03
1909.....	12,825,169	4,646,869.21	2,417,767.21	2,180,407.02
1910.....	13,388,039	5,596,135.80	3,008,957.80	2,742,842.58
1911.....	5,829,254	4,678,074.14	2,507,196.98	2,381,712.54
1912.....	3,701,726	4,719,578.21	2,893,276.54	2,827,317.62
1913.....	2,657,250	4,844,169.41	2,945,335.30	2,920,714.26
1914.....	868,425	3,999,862.51	2,221,194.68	2,202,196.62
	56,167,813	36,585,280.24	\$21,000,158.52	\$19,771,370.69

Dividends Paid to December 31, 1914.

	By Nipissing Mining Co., Ltd.	By Nipissing Mines Co.
1905 To Syndicate	\$300,000.00	
1906 " " " "	100,000.00	
1907 " " " "	500,000.00	\$480,000.00
1908 " " " "	880,000.00	840,000.00
1909 " " " "	740,000.00	720,000.00
1910 " " " "	1,370,000.00	1,350,000.00
1911 " " " "	2,122,500.00	2,100,000.00
1912 " " " "	1,853,430.49	1,800,000.00
1913 " " " "	1,842,366.76	1,800,000.00
1914 " " " "	1,835,000.00	1,800,000.00
	1,380,000.00	1,350,000.00
	\$12,923,297.25	\$12,240,000.00
Dividend declared Dec. 21, 1914..	310,000.00	300,000.00
	\$13,233,297.25	\$12,540,000.00

Sources of Production.

	Tons	Tons
From Underground—		
Shaft 73	53,719	
Little Silver	7,493	
Shaft 122	4,811	
H-52	5	
	66,028	
From Dumps—		
Vein 80	13,231	
Vein 96	128	
Vein 122	653	
	14,012	
	80,040	1,363
Less 1.70% moisture		
Total production	78,677	1,028
High Grade Ore and Concentrate Produced		
Low Grade Ore to Battery Bins	77,649	

Production of Individual Veins in 1914.

	Silver Ozs. in High Grade Ore	Silver Ozs. in Mill Rock	Total Silver Ozs.
Shaft 73—			
Veins 73, 80, and 100 ...	1,968,243	1,890,298	3,858,541
Vein 96	3,616	3,616	3,616
Vein 122	176,358	154,342	330,700
Little Silver	274,577	211,514	486,091
H-40 and H-52	9,131	1,254	10,385
	2,428,309	2,261,024	4,689,333

High Grade Mill.

There have been no additions to the high grade plant during the year and no change in treatment.

The mill treated 929 tons of Nipissing ore having an average value of 2,439 oz. per ton, and 965 tons of custom ore averaging 2,421 oz. per ton. In addition to this, the refinery treated the precipitate from the low grade mill. The total shipments of bullion during the year amounted to 6,300,177 fine oz.

The market for Cobalt nickel residue was good during the first half of the year, but since the war started all foreign consignments have been cut off.

Total shipments of residue amounted to 1,060 tons, which gave a net return of \$42,344.06.

Bullion and Cobalt residue were the only products shipped by the company during the year.

Experiments are now being conducted with the Cottrell process on the fumes from the furnaces, the object being a possible further saving of silver and mercury.

Low Grade Mill in 1914.

	Dry Tons.	Assay Ozs.	Silver Ozs.
Ore Treated	79,009	30.82	2,435,345
By-products Treated	116		87,081
Total milled	79,125		2,522,426
Bullion recovered from the above			2,261,024
Actual extraction by clean-up			89.64%

The low grade ore averaged 3.6 oz. per ton higher than in the previous year and the mill treated 1,885 tons more.

Research work on the low grade mill operations proved that practically all the rock in the final tube mill discharge will pass a 200 mesh screen, but that the metallics in the ore are flattened out and remain on the screen. Two Callow screens were therefore installed in the tube mill circuits and these are now recovering from 20 to 25 per cent. of the total silver in the ore. The dirty metallics from the screens are cleaned on a Wilfley table and the product is melted into bullion. It is expected that this preliminary treatment will lower the cost in the cyanide plant and increase the extraction.

Consumption of Supplies at Low Grade Mill.

	Lbs.	Lbs. Per Ton	Cost Per Lb.	Total Cost Per Ton
Cyanide	421,813	5.331	\$1.555	\$8.292
Lime	454,876	5.749	.0042	.0242
Caustic Soda	242,014	3.059	.0211	.0647
Aluminum Dust	46,836	.592	.3382	.2002
Aluminum Plates	41,858	.529	.2467	.1305
Aluminum Ingots	13,586	.172	.1925	.0331
Flint Pebbles	302,695	3.826	.0084	.0331
Coal for Heating	2,532,100	32.001	.0029	.0933
Power, K.W.H.	4,264,000	53.889	.0117	.6384

\$2.0457

Forty stamps ran 329.17 days or 89.12 per cent. of possible running time. Crushed per day 240.38 tons; crushed per stamp per day 6.01 tons.

Nipissing Treatment Costs.

	Total Cost	Cost Per Ton
Including Transportation, Picking Plant, Low Grade Mill and Construction. Based on 79,125 Tons Milled.		
Crushing at mine	\$10,124.44	.128
Aerial tramway	5,142.23	.065
Surface tramway	5,469.79	.069
Picking plant	-16,118.17	.204
Crushing and Conveying	3,804.73	.048
Battery	21,782.20	.275
Tube Mills and Classifiers	45,457.57	.575
Desulphurizing and Slime Collecting	24,093.68	.304
Intermediate Filtering	8,776.46	.111
Cyanide Treatment	85,130.68	1.076
Cyanide Filter	10,892.15	.138
Clarifying and Precipitation	22,819.56	.288
Refining	8,785.21	.111
Heating	9,317.46	.118
Water Supply	2,878.40	.036
Construction	26,437.33	.334
Residue Dam	4,632.97	.059
Consulting	3,987.56	.050
	\$315,650.59	\$3.989

Notwithstanding the increase in the cost of cyanide and other supplies, the total cost of treatment was \$.14 per ton less than in 1913.

Nipissing Surface Prospecting.

The hydraulic plant was moved from Cobalt Lake to Peterson Lake and nearly all the ground draining into Peterson and Cart lakes from the west was washed clear of soil.

Acres washed, 95.55; cost per acre, \$499.47; cost per cubic yard, 9.01c., made up of: labor, 4.99c.; power, 3.20c.; supplies, .82c. Average depth of soil, 3.43 ft.; 153 set-ups made; 34,540 ft. of 16 in. pipe taken up and 33,769 ft. laid down; 18,730 ft. of roads built; average pressure at nozzle, 138 lb.; pump ran 79 per cent. of possible running time.

The area washed had been previously trenched, but it was largely conglomerate and was thought to be as promising as any ground we have. The results were not as good as expected; the only vein of importance found was H-52, from the outcrop of which 10,000 oz. in high grade ore was taken. This vein will be opened up next summer.

Several diamond drill holes aggregating 1,159 ft. were put down on the eastern side of Peterson lake without favorable results. One hole near the edge of the lake showed 300 ft. of diabase, then 38 ft. of slate lying on top of the Keewatin.

Summary of Underground Work, Nipissing Mine, 1914

Shaft No.	Drift-ing Feet	Cross-cutting Feet	Raising Feet	Sinking Feet	Total Feet	Stoping Cubic Yards
63	479.5	172.0	14.0		665.5	4,578
64	596.5	708.0	31.5	215.5	1,551.5	
73	3,014.0	2,358.5	1,205.5	273.0	6,851.0	20,418
80						754
86	532.5	553.5	113.0		1,199.0	
122						348
150	256.0	1,376.5	195.0		1,827.5	
H-40				53.0	53.0	
H-52						253
Total	4,878.5	5,168.5	1,559.0	541.5	12,147.5	26,351

Development.

The 12,148 ft. of development compares with 13,665 ft. done in 1913. Stoping was very much less—26,351 cubic yards compared with 44,018 cubic yards during the previous year. The tonnage of ore broken down and ready for hoisting was increased, however, from 65,393 tons to 75,806 tons. A large part of the ore produced came from development.

Shaft 63.—The only work done from this shaft was the development and stoping of the Little Silver veins, which gave very satisfactory results. Two stopes were carried up from the 175 ft. level toward the surface; one of these broke into the old tunnel workings.

The reserves amount to \$655,065 oz., most of which is in broken ore in the stopes.

Shaft 64.—This vein, which is the largest and strongest fissure on the Nipissing property, has been prospected to a depth of 1,065 ft. on the dip of the vein. Several valuable ore shoots were opened up in the conglomerate above the 275 ft. level, but they did not extend into the underlying Keewatin. As the vein was strong and carried low silver values throughout, it was considered advisable to explore it at depth and the main shaft was therefore sunk to the 902 ft. level. A crosscut 272 ft. long was necessary in order to reach the vein, which was then drifted on for 454 ft. From this level an inclined winze was sunk and 53 ft. of drifting was done on the lowest level, which has a vertical depth of 1,003 ft. from surface, making it the deepest working in the Cobalt district.

All this work at depth failed to develop any pay ore; the vein, while narrower, is still strong, but only assays from 5 to 20 oz. silver.

The third levels of shafts 64 and 73 have been connected by a crosscut; all ore hereafter will be hoisted through shaft 73.

Shaft 73—The vein system at shaft 73 continues to be by far the most important part of the company's resources. More development work was done here than on all the rest of the property together and the shaft produced 80 per cent. of the ore hoisted.

The main 73 ore shoot has consistently followed down the conglomerate Keewatin contact, the ore occurring entirely in the upper formation. The bottom of the main orebody has been definitely determined throughout its entire length by the developments along the contact between the third and fourth levels.

On the third level, however, a number of branch veins were opened up, which by turning off nearly at right angles to the main vein, continued in the conglomerate formation. These branches proved of much importance and on one of them, known as No. 98, an ore shoot 575 ft. long has been developed on the fourth level.

From this vein in turn, five new branch veins have been opened up on the fourth level and these promise well for the future. In fact, the fourth level results for the year have been most satisfactory. Three winzes sunk below the fourth level have located the Keewatin at a depth of from 50 to 70 ft.

A new shaft was raised from the fourth level to the surface at a point close to our eastern boundary, and this has improved working conditions materially by giving good ventilation throughout the mine and providing another outlet for waste rock.

The stoping of the branch veins and of the main vein has been almost completed above the third level, much of this ore being still in the stopes ready for the mill. Drifting on the various veins on the fourth level provided a large part of the ore sent to the mill during the year.

The ore reserves at 73 shaft consist of 3,103,685 oz. in high grade and 1,747,020 oz. in mill rock.

Shaft 80.—The only work done at this shaft was a small amount of stoping on 80 vein. The reserves in 80 and 100 veins consist mostly of broken rock in the stopes and amount to 1,841,000 oz.

Shaft 86.—This shaft is situated on the west side of Cart lake and serves for the development of veins 86, 88, 89, 99 and 146. Some 1,200 ft. of work was done on these veins. The high grade ore developed is of small consequence, but there will be a fair production of mill rock from this shaft.

Shaft 122.—The remaining ore in vein 122 was broken down, the stopes were drawn off and all work in this shaft discontinued.

Shaft 150.—We have continued to explore through shaft 150, the tract of conglomerate on the east side of Cart lake. The work has consisted of crosscutting on the first, second and third levels, drifting and raising on three calcite veins. So far this work has been unsuccessful, though the formation is favorable and good orebodies have been opened up on adjoining properties. Some further work on this ground is planned for the coming year.

H-40 and H-52.—These veins were uncovered by the hydraulic operations during the year and some 10,000 oz. of silver was taken from the outcrop; they will be developed underground during the coming season.

Nipissing Ore Reserves, December 31, 1914.

Shaft No.	Developed and Partly Developed Ore		Mill Rock		Ounces
	Tons	Ounces	Tons	Assay	
73.	1,900	3,103,685	87,351	20	1,747,020
64.	230	240,303	5,507	20	110,140
80.	269	628,750	12,722	25	318,050
100.	260	609,400	11,392	25	284,800
63.	165	452,700	8,301	24.4	202,365
	2,824	5,034,838	125,273	21.3	2,662,375
Dumps.			97,337	23.8	2,319,863
			222,610	22.4	4,982,238

Summary.

	Tons	Assay	Ounces
High Grade Ore	2,824	1783.	5,034,838
Mill Rock	222,610	22.4	4,982,238
Total	225,434		10,017,076

Summary of Results, Nipissing Mining Co., 1914.

Although the price of silver has been very low since July, the result of the company's operations during the past year has been most satisfactory.

The mine produced 4,689,333 oz. of silver at a cost including every expense, of 19.8 cents per oz. This compares with a production of 4,552,173 oz. at a cost of 24.09 cents during the previous year. The working charges were reduced from \$14.19 to \$11.60 per ton of ore.

The net return was \$1,587,621.16 as against \$1,660,271.44 in 1913; this falling off is due to a drop in the price received for silver from 60.261 cents in 1913 to 55.365 cents in 1914. Dividends declared during the year amounted to \$1,235,000.

Both the high grade mill and the low grade mill worked at full capacity throughout the year and at a less cost per ton of ore treated. The production was about equally divided between high grade ore and low grade mill rock. A larger amount of custom ore than usual was treated by the high grade mill, the total shipments of bullion from the refinery amounting to 6,300,000 fine oz.

Considerable work is being done on the Teck-Hughes mine in the Kirkland Lake district, for which expenditures the Nipissing Company is receiving treasury stock of the Teck-Hughes Company. A number of other outside properties have been investigated, but no interests acquired.

The developments underground during the year were exceptionally good. The reserves, which now stand at over ten million ounces, are the largest ever shown by the company. This amount is assured and the past history of the company and the present bright outlook make us confident that future developments will show their usual good results.

Treasurer's Report.

Statement of Operations, Dec. 31, 1914.

Gross Settlements 1913 Ore (paid for in 1914)	\$191,212.66
Gross Settlements 1914 Ore	2,914,888.29
Gross Settlements for year	\$3,106,100.95
Gross Value of Ore and Bullion at Mines and in Transit December 31, 1914	1,129,539.58
	\$4,235,640.53
Less:	
Gross Value of Custom Ore purchased	\$1,284,751.20
Gross Value of Inventory, December 31, 1913	434,824.48
	1,719,575.68
Gross Value of 1914 Ore	\$2,516,064.85
Other Receipts:	
Ground Rents	\$20,157.50
Interest, Discount, etc.	22,510.34
	42,667.84
	\$2,558,732.69

Cost of Mining and all other expenses (including Smelter Deductions, Treatment, etc., on Settlements 1914 Ore and Accrued Charges on Ore and Bullion at Mine and in Transit)	971,111.53
Net Receipts for 1914 Production	\$1,587,621.16
Cost of Special Investigations	8,905.92
	<hr/>
Surplus, January 1, 1914	\$1,578,715.24
	1,259,060.96
	<hr/>
	\$2,837,776.20
Less:	
Dividends declared and paid during 1914	\$935,000.00
Dividend payable January, 1915	300,000.00
	<hr/>
	1,235,000.00
Net Surplus to Balance Sheet	\$1,602,776.20
This Net Surplus is made up as follows:	
Cash in various banks	\$391,291.64
Ore and Bullion at Mines and in Transit	1,129,539.58
Accounts receivable	25,058.35
Investments	69,519.61
Mining Plant, Equipment and Supplies	496,886.75
	<hr/>
	\$2,112,295.93
Less:	
Accrued Expenses on Ore and Bullion not settled for	\$18,997.47
Accounts Payable (including estimated Taxes)	190,522.26
Dividend Payable January, 1915	300,000.00
	<hr/>
	509,519.73
Net Surplus	\$1,602,776.20

Balance Sheet, Dec. 31, 1914.

Assets.

Mining Property	\$250,000.00
Mining Plant, Equipment and Supplies	496,886.75
Investments	69,519.61
Ore and Bullion at Mine and in Transit	1,129,539.58
Accounts receivable	25,058.35
Cash in Banks, New York, Toronto and Cobalt	391,291.64
	<hr/>
	\$2,362,295.93

Liabilities.

Capital Stock	\$250,000.00
Accounts Payable, including estimated Taxes	190,522.26
Accrued Expenses on Ore and Bullion	18,997.47
Dividend Payable January, 1915	300,000.00
Surplus (See Statement of Operations)	1,602,776.20
	<hr/>
	\$2,362,295.93

WAR ORDERS.

Dunkirk, N.Y.—Official confirmation is given out by Vice-President James McNaughton of Brooks plant of American Locomotive Co., of the award of contracts by European allies for 2,500,000 shells, the total value of the contracts aggregating \$40,000,000. American company was lowest bidder for the work, and one of the principal specifications is prompt delivery. In order to facilitate execution of the big order it will be necessary to instal nearly \$1,000,000 worth of new machines. Contracts given by the Russian and English governments figure close to \$70,000,000, part of which went to the New York Air Brake Co., and the Westinghouse Co.

The capacity of the Dunkirk plant will be 3,000 shells a day and at Montreal 1,000 will be turned out daily. The work will require the running of the Dunkirk plant night and day for two years.

It is provided that in case of the war coming to an end full payment shall be made on account of the expense to be incurred in the installation of machinery. The Brooks plant has been running at one-fifth capacity for a year.

Pittsburg.—Crucible Steel Co. has booked a war order valued at \$20,000,000. The report that the company had closed this contract was accompanied by an advance in stock on Saturday to 20, up 4 points.

New York.—The past week, while it brought few new contracts for war material, saw publication of

many additional details of business already in hand, or for which contracts were about to be signed. The magnitude of this business has become more evident as details have come to light, and stocks of companies which have contracts for war material have continued to be the center of speculation.

“Shrapnel” has been a word to conjure with. Estimates of orders for this material are always expressed in at least eight figures. Equipment companies, most of whose machinery has long been idle, have put their boring machines to work on shrapnel instead of engine cylinders. Contracts closed or about to be closed by American Locomotive Co. are estimated all the way from \$30,000,000 to \$75,000,000. Interests close to the company place the total at \$65,000,000. This material is for the Russian government, and the company’s contract insures it against loss of profits in case of the ending of the war.

T. M. Latimer of Pittsburg, according to despatches, has practically closed contracts which will amount to \$35,000,000 for munitions of war and other material. Empire Trust Co. of New York is in charge of the contracts.

Other concerns which have figured in the shrapnel business are New York Air Brake Co., with orders estimated at \$30,000,000; Laekawanna Steel, Carnegie Steel and Crucible Steel. Westinghouse Air Brake, said to have a \$20,000,000 shrapnel contract with France, and American Car & Foundry. Chicago despatches say American Steel Foundries Co. has gotten a share of the big order being distributed to American equipment concerns. E. W. Bliss Co., Brooklyn, turning out 30,000 shrapnel shells a day, is building a third addition to its plant, it is reported. Details of order placed with Canadian Car & Foundry Co. are to effect that the contract calls for 2,500,000 explosive and 2,500,000 shrapnel shells, the whole contract calling for more than \$80,000,000. The first order for 2,000,000 will be completed this year and the balance will be ready by the end of January, 1916, according to a statement issued by Nathaniel Curry, president of the company. The Standard Steel Car Co. is about to start work on a big order for shells.

Other similar business is an order for 60,000,000 cartridges—more than a year’s output—taken by United States Cartridge Co. from Great Britain.

Studebaker Corporation within 10 days has booked about \$3,000,000 of additional war contracts for harness and vehicles. Previous orders of this company amounted to something like \$14,000,000.—Boston News Bureau.

STUDENTS ENLISTING.

Enlistment at the University of Toronto, instead of falling off with the approach of spring, has increased, and each day the registrar’s office is besieged by new applicants. The latest list, which, however, lacks about fifty names, shows the following number of men on active service:

- Graduates—Officers, 187; in rank, 119.
- Undergraduates—Officers, 60; in ranks, 275.
- Staff—Officers, 34; in ranks 5.

To this must be added about 100 students and members of the staff who are in the base hospital.

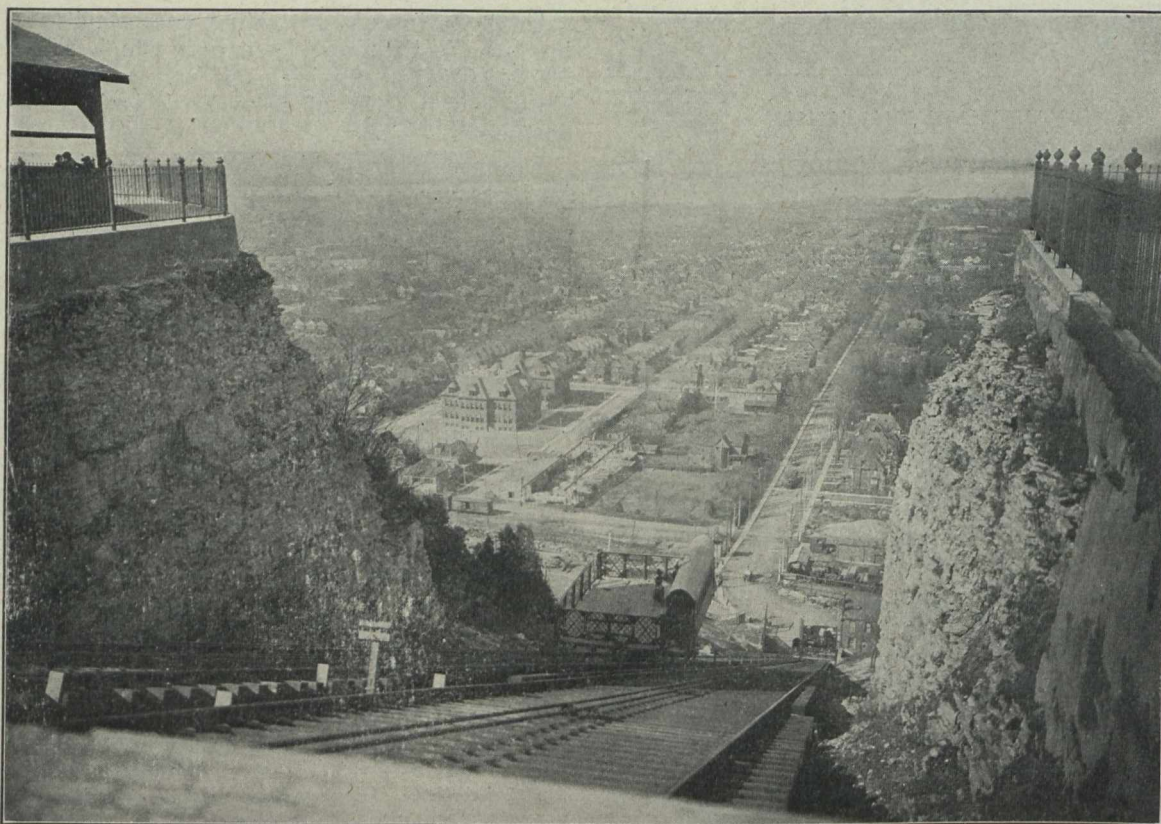
The Officers’ Training Corps is now idle, awaiting news of their ten-day encampment at Niagara. If the camp idea is set aside, it is said the corps will disband for the summer.

A LARGE ELECTRIC HOIST AT HAMILTON, ONT.

An electric hoist of unusual size with many interesting automatic safety devices was recently installed by the Hamilton Mountain Park Co., Limited. Although the incline on which it is used to raise and lower cars is called a railway, this apparatus is really a development of a mining hoist on a very large scale and with special reference to the demands upon it. The difference in elevation between the general level of the city and the country at the top of the mountain is about 325 ft. Originally a steam hoist was used to transfer waggons, automobiles and passengers. This became inadequate to handle safely and quickly the

Attached to each car are two ropes of $1\frac{5}{8}$ in. diam. each rope weighing 4.15 lb. per ft. One of these ropes is used for hauling the car, and the other for the purpose of safety. The average rope speed during the run is 585 ft. per minute.

Incline arrangement.—The hoist is located in a house 106 ft. from the knuckle between the incline and the level of the summit. The main rope from the right hand car is wound over the top of the right hand hoist drum. The main rope from the left hand car is wound underneath the left hand hoist drum. The safety rope from the right hand car is led over suitable deflecting



Hamilton Mountain Park Incline.

ever increasing traffic, and the company, of which Mr. George F. Webb is president, gave to the Canadian General Electric Co. a contract for an electric hoist to take its place.

A special double fixed drum double geared electric incline hoist, built by the Lidgerwood Manufacturing Co., of New York, operates two cars in balance on an incline 800 ft. long, with a grade of 40.27 per cent. Each car weighs 30,000 lbs. and runs on tracks having a gauge of 12 ft. $1\frac{1}{2}$ in., the centre to centre of tracks being 20 ft. 3 in. The average load on the cars will be about 20,000 lb., with a maximum load of 30,000 lb. The hoist arrangement is suitable for either hoisting the maximum load with empty car descending, or for lowering the maximum load with the empty car ascending.

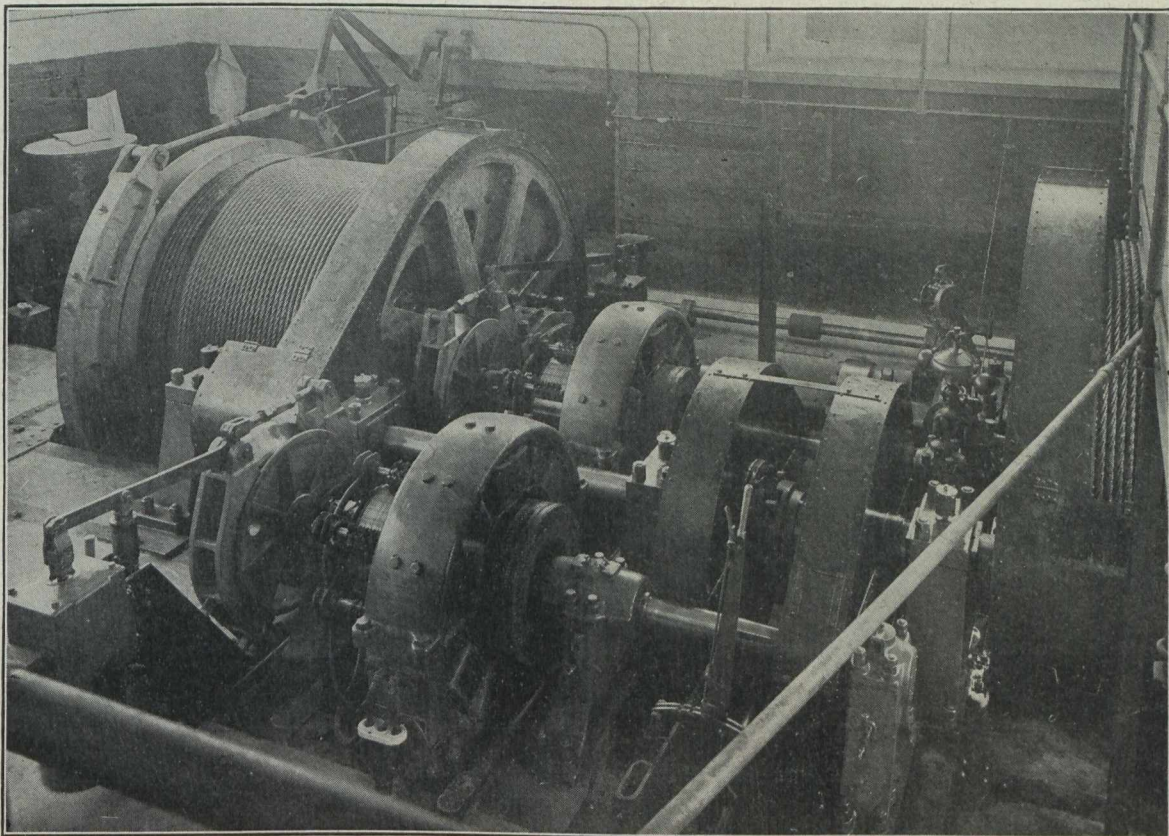
The time required for making a single trip is $1\frac{1}{2}$ minutes, and the rest period between trips 3 minutes.

sheaves to the top of the left hand drum, and the safety rope from the left hand car is wound over suitable deflecting sheaves to the bottom of the right hand drum. Each of these sheaves is 7 ft. diameter to the bottom of the rope groove and weighs 3,500 lb. There are four head sheaves and four deflecting sheaves. The head sheaves are arranged vertically so as to carry the hoist ropes and safety ropes in a direct line from the cars, the deflecting sheaves are placed horizontally at such an angle that the rope will be led in a direct line to either the top or bottom of the hoist drums, as the case may be. Floating sheaves are also furnished to guide the ropes and are placed in the rope tunnels between the head sheaves and the hoist drums.

The reason for reeving the safety ropes as outlined above is that in case of an accident to the left hand side of the hoist the safety rope on the left hand car would take care of it properly, being wound on the right

hand drum; the same thing would apply if the other drum of the hoist should become disabled, that is, the main ropes and the safety ropes from each car lead to opposite drums. Further advantage is gained by the fact that each drum is equipped with an independent double acting brake, and in case either of the main ropes should break, the safety rope will hold the cars. Furthermore, the safety rope, if called upon to take the load, will be controlled by all the automatic brake features in exactly the same manner as when the load is being handled by the main ropes. In actual operation the length of the safety ropes will be slightly more than that of the main hoist ropes, thereby relieving the safety ropes of any hoist stresses other than those required to keep the ropes themselves in motion.

he will of necessity remove his foot from the foot pedal thereby cutting off the current, bringing the cars to rest. In order for the cars to move, the operator's foot must be on this pedal. In case the cars should stop short of their landing positions due to the automatic overwinding mechanism, there are available two or three points on the controller so that the operator can bring them to their proper positions. Should the cars fail to stop due to the fault of controller, an attached overwinding device will shut off the current and set the solenoid brakes. Should the speed of the cars exceed the normal by a predetermined amount an over-speeding device will trip a weight of 570 lbs. which will set the drum post brakes. This over-speeding device or governor is of the fly ball type, and it will be caused to



Hamilton Mountain Park electric hoist, showing both motors, solenoid brakes and fly ball governor speed limit safety device.

Operation and safety appliances.—The operator's cabin is fitted with one electric control and two hand brake levers. The levers will not be used ordinarily as the hoist is equipped with solenoid brakes operating on the motor shaft. The hand brakes, therefore, need only be used for the locking of the cars at the top and bottom positions or for cases of emergency. In starting a run, the operator releases the drum post brakes by the hand levers, puts his foot on the small foot pedal located at bottom of master controller and moves the handle of the controller to either the right or the left as the case may be. The cars will start and will automatically accelerate to the normal rope speed. At a predetermined point on the incline, the controller handle will be automatically turned to such a position that the speed will be cut down to 1-10 of the normal and finally be turned to the off position, thus setting the solenoid brakes and bringing the cars to rest.

Should the operator become disabled during a run,

operate by an excessive speed, whether due to motor or a breakage of the hoist parts. The emergency weight may also be tripped manually from the cabin.

Shafts and drums.—The drum shaft is steel forging made in two pieces, 12 in. diameter. Including the two sections it is 32 ft. long and weighs 13,300 lbs. The intermediate shaft has been machined from a single steel forging and is 7 in. diameter its entire length. It is 20 ft. long and weighs about 3,000 lb. There are two cast iron drums 96 in. diameter, 70 in. face and coil 800 ft. of $1\frac{5}{8}$ in. rope, plus three holding coils at each end on one layer.

The intermediate gears are of cast steel with herringbone teeth, cut. The intermediate pinions are of forged steel.

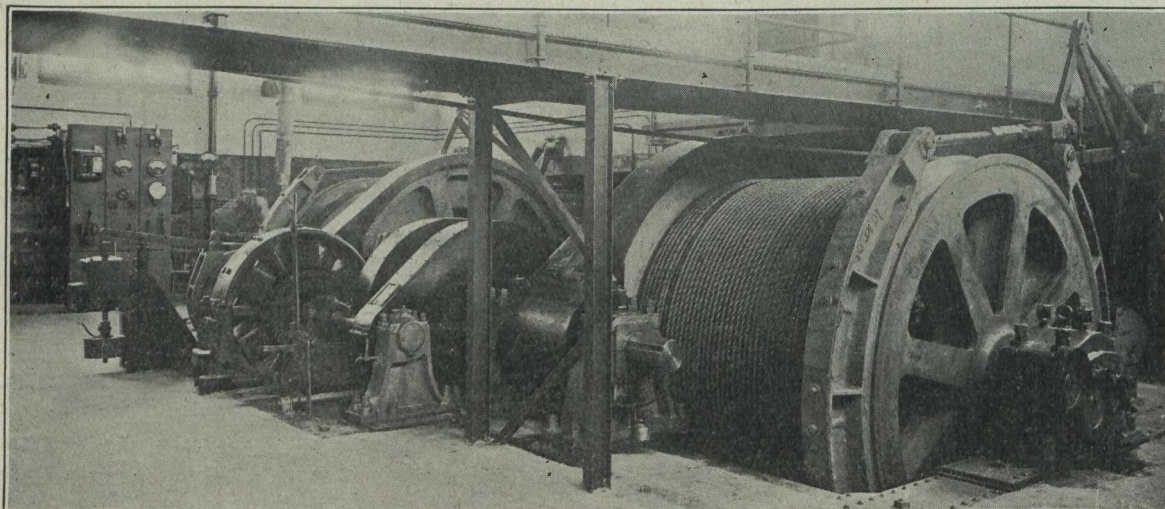
Electrical equipment.—Power is supplied in the form of 3 phase, 25 cycle, alternating current, and for transforming this to direct current a Canadian General Electric motor generator set has been installed of sufficient

capacity to supply the average demand of the hoist, plus some surplus for charging the battery described below. The direct current end of this machine is rated at 165 amperes continuously at 550 volts, the latter being the floating voltage of the battery. This generator is driven by a 2200 volt induction motor. The generator end is designed with a special drooping characteristic by means of a reversed series field for the purpose of throwing load fluctuations on the battery. A small percentage of the load fluctuations falling on the machine will lower its voltage to such an extent that the battery must discharge and furnish the balance of the momentary demand. The regulation is, therefore, inherent in the design of the machine, and is entirely automatic.

The hoist is driven through two gear reductions, the total ratio of which is 29.84 to 1 by a General Electric 180 h.p. 500 volt 475-585 r.p.m. direct current motor which is especially designed to stand such voltage variations as come from a storage battery when it is frequently charging and discharging. The motor is controlled by a General Electric magnetic contactor panel so that it is convenient to control the motor remotely

ing approximately 550 volts. Under the conditions of maximum schedule it was estimated that the load period of 90 seconds, mentioned above, would be followed by a three minute rest, thus providing for a trip of the hoist every four and a half minutes. For handling a 10-ton load, the maximum ten second demand was estimated at 530 amperes followed by 80 seconds of load varying from 470 down to 310 amperes. The hoist is designed to handle a 15-ton load occasionally, but this will not occur when the battery is handling the entire load with the power supply cut off. It is believed that hoisting a 7½ ton load every four and a half minutes will represent the average conditions during the hours of maximum traffic. The average load is 11½ amperes on this basis.

The battery consists of 262 cells of the Tudor Box type. Each cell contains 11 plates, type F, measuring approximately 11x10½ in., five of the plates being positive of the Tudor type and six of the plates being negative of the Box type. The plates are supported in glass jars mounted on glass sand trays, the entire battery being installed on wooden racks. The capacity of this battery is 200 amperes for one hour on continuous dis-



Hamilton Mountain Park electric hoist, showing interpole motor, solenoid brake and over-winding protective device on drum shaft.

from the operator's station. This system of control admits of the various protective devices already described to ensure against the cage operating at greater than a pre-determined speed. To ensure a greater degree of continuity of service a reserve General Electric 180 h.p. motor and solenoid brake are provided. The machinery of the hoist is so constructed that in a very few moments' time one motor can be disconnected from the hoist and the other clutched in ready for service. The master controller is situated in the operator's cabin at the top of the incline.

Storage battery.—The power plant has been supplemented by a storage battery built by the Electric Storage Battery Co., of Philadelphia. One of the objects of installing this was to reduce the maximum peaks due to the fluctuating load of the hoist, and thus reduce the power bills. Another object was to furnish current for operating the hoist if alternating current supply is interrupted.

The demand of the hoist motor when lifting a load of 7½ tons was estimated at 470 amperes for ten seconds, followed by a demand varying from 410 down to 230 amperes for a period of 80 seconds, the voltage be-

charge. For intermittent service extending over several hours the ampere hour capacity will be somewhat greater and it is estimated that this battery will operate the hoist under the average load conditions cited above over one and three-quarter hours with the power supply entirely cut off; or if the schedule is reduced, so that the trips of the hoist are made less frequently, the hoist can probably be kept in operation for several hours.

Under normal conditions with the motor generator supplying the average load, the battery does not become exhausted, but receives back sufficient charge during the period of rest between trips to make up for the discharge while the hoist is in operation. The battery, therefore, while relieving the motor generator and power line of the severe load fluctuations is maintained at all times practically full and ready to supply the entire demand in case of interruption to the power supply.

The Dorr Cyanide Machinery Co. announce that after May 1st, 1915, their New York office will be located at 17 Battery Place.

PERSONAL AND GENERAL

Mr. Jack Hammell is at Porcupine.

Mr. Alex Gray visited Porcupine this month.

Mr. Colin Campbell, of Campbell & Deyell, Cobalt, has joined the aviation corps.

Dr. A. Ledoux, professor of mineralogy at Brussels University is in Toronto, having joined the staff of the University of Toronto.

Over 300 members of the Institution of Mining and Metallurgy have enlisted, many are commissioned officers. Among those killed in action are William Hopkinson, Maurice Percival and Ernest John Murray.

Mr. G. Schack-Sommer, M.I.M.M. serving with the Russian army, has been awarded the St. George's Cross for valor.

Mr. James Ashworth addressed an audience in Vancouver, B. C., on April 14 on the subject of Mine Explosions. Various preventive methods were explained, and lantern slides were used to illustrate the subject dealt with.

Mr. Wm. Blakemore headed a committee of the Victoria, British Columbia, Board of Trade which waited on Mr. David Carnegie, Prof. Alfred Stansfield of McGill University, and Dr. Alfred W. G. Wilson of the Mines Branch of the Canada Department of Mines, on the occasion of those three gentlemen visiting Victoria on April 12 in connection with their investigations relative to the facilities on the Pacific coast of Canada for the manufacture of shells, and the conditions bearing on the practicability or otherwise of establishing copper and zinc refineries in British Columbia.

Mr. R. W. Brock, dean of the College of Applied Science, University of British Columbia has attached himself to a local regiment so that military duty now occupies much of his time.

Mr. G. J. A. Buisson, formerly on the mining engineering staff at the Consolidated Mining and Smelting Co's Centre Star group of mines at Rossland, B.C., is now with the Mines Branch, Canada Department of Mines, Ottawa.

Mr. John Brown, late general manager for the Hillcrest Collieries, Ltd., Southwest Alberta, was a short-time ago presented with a valedictory address and a valuable gift on his leaving the Blairmore-Frank district for the United States. Those who paid him this kindly compliment were members of the Western Coal Operators' Association and other friends in the district with the coal mining industry of which he had long been actively connected.

Mr. John D. Galloway, of Victoria, assistant mineralogist for the Province of British Columbia, has prepared his first official bulletin in that capacity and it has been printed as Bulletin No. 4, 1915, of the British Columbia Bureau of Mines. Its title is "The Mineral Resources of a Portion of the Omineca Mining Division." It is obtainable, gratis, on application to the B. C. Dept. of Mines.

Prof. Arthur Lakes has contributed to the Daily News, Nelson, B. C., some interesting notes on the subject of "Cottage Gardens in High Mining Camps." After giving some useful and interesting information, he concluded his notes with these words. "This subject may seem trivial except to those who have experienced the isolation common to many mining camps where nothing is trivial that contributes ever so little to comfort and interest. We hope that members will

try the experiment and that some of our mining camps may become as attractive as many country spots and villages."

Sir Richard McBride, premier and minister of mines for British Columbia, who was in Ottawa early last month, afterward proceeded to New York, and thence to London on official business.

Mr. Thos. McGuckie, formerly of Nanaimo Vancouver Island, B. C., where he was for some time general superintendent for the Western Fuel Co., was one of those injured at the Britannia mine when about six weeks ago, a disastrous slide occurred there. Fortunately he was not very seriously hurt.

Mr. W. G. Norrie, late of Vancouver, B. C. for a number of years engaged in mining engineering in Alberta and British Columbia, is now with the Consolidated Mining and Smelting Co. at Trail, B. C.

Mr. Geo. W. Otterson, of Seattle, Washington, manager for the Kildare Mines, Ltd., an Eastern Canadian organization operating in the Omineca placer gold field in British Columbia, is preparing for the ensuing season's work.

Mr. Grant B. Schley, Jun., of New York, son of the head of the Howe Sound Copper Co., of that city, which controls the Britannia Mining and Smelting Co., will again spend some time at the company's property in Vancouver mining division, British Columbia. He was expected to arrive from the East in April.

Dr. W. G. Miller, A. G. Burrows and T. F. Sutherland were at Porcupine last week.

Mr. H. Foster Bain, formerly Editor of Mining Press and now Editor of the Mining Magazine sailed from New York, April 17 for London.

OBITUARY.

Clarence Edgar Copeland, mining engineer, and his wife were among the 53 who were killed in the snow and rock-slide that overwhelmed the upper camp of the Britannia mines, in British Columbia, in the early hours of March 22. Mining Press states that Clarence Copeland graduated with honors from the Colorado School of Mines in 1913 and since then had been engaged in professional work on the Pacific coast. He was only 25 years old, and had begun a most promising career. On January 6, 1915, he married Katherine Nora Holland, of Seattle, Washington, who died with him. He is survived by his father and mother, Mr. and Mrs. J. S. Copeland, of Los Angeles, California.

The Germans are still distributing documents to prove that Belgium was in conspiracy with England to bust the German Kultur.

In this particular the Germans are in the position of an intending burglar, who feels that a householder seen speaking to a policeman ought to be run in.—Life.

The Slocan Record, published at New Denver, on the eastern shore of Slocan lake, British Columbia, recently published the following among its news items: It is not improbable that before another year the greater portion of the Slocan ores will be treated at Kingston, Ontario. The Kingston smeltery offers a net return of about \$6 a ton more than the Trail people.

SPECIAL CORRESPONDENCE

COBALT, GOWGANDA AND SOUTH LORRAIN

Once more the steam plants are shut down and the mines have all the electric power and compressed air they require without any recourse to their own plants.

This should reduce the large number of idle men who have been hanging around the camp all winter. The chief advantage will be in the mills which have been obliged to shut down in rotation for a quarter of the time since early in the year. It is most probable also that the favorable stock conditions will lead those companies who have been hesitating to resume to take the advantage of ample power to recommence operations. There will not be the excuse of lack of power to prevent them doing so, since the power company has notified all those who have made previous application of their intention and ability to give them all the air they want. Among those likely to resume are the Columbus, the Shamrock, the old Salvador and several other properties in southeast Coleman township.

Right of Way has already recommenced operations at the old shaft between the Cobalt Townsite and the Cobalt Aladdin or, as it is better known, the Silver Queen. For some time the drills will be used to break down the low grade ore that is known to exist in the old workings. A contract to mill thirty tons a day has been made with the Northern Customs concentrator. Later some further exploration work will be done in the endeavor to pick up new orebodies.

Elk Lake.—A small quantity of ore has been shipped from the Mapes Johnston mine at Elk Lake to Cobalt for the purpose of concentration and reshipment. The two and a half tons shipped was high grade and will run about 1,500 oz. to the ton.

Temiskaming.—The development at the Temiskaming mine still continues to disclose remarkable ore. The orebody has now been definitely located on three levels of the Temiskaming from the Beaver workings and three from the Temiskaming crosscuts. In the faces of two of these drifts the ore is remarkable, in the third it is good milling rock at the present. At the 400 ft. level, where the ore when first crosscut was only low grade, some of the most remarkable ore ever mined in the camp has been found. The vein at one place was from 8 to 9 in. wide of ore that has never been surpassed for richness. But the Temiskaming ore always runs in lenses, and any attempt to estimate ore reserves on present faces is fraught with great danger.

In addition to the new vein system, the end of an old ore-shoot has been uncovered on the 450 ft. level. The drift wherein the ore was found had been abandoned some time ago. It was cleaned out some few days ago and a very little exploration discovered five inches of remarkable ore in the end of the old vein that was being followed. As there is about a hundred feet of ground that has not been crosscut, it is reasonable to suppose that this working may yield a quantity of high grade ore.

The mill is running to capacity on development ore alone after all the high grade has been hand picked and passed over the bumping table.

Paragon.—One of the few properties working in the Elk Lake district is the Paragon Cobalt in Barber

township. A small gang of men is putting down a shaft on an encouraging showing.

Shipments.—There has been a general resumption of bullion shipment during the past two weeks. Two-thirds of the ore is going to New York, where it is being sold to bullion brokers. This is the case with all the Nipissing bullion. Bullion shipped from the other mines and concentrators is crossing the ocean again in spite of the fact that the high insurance rate of ten dollars a thousand dollars is being maintained.

Chambers-Ferland.—Action has been entered restraining the Chambers-Ferland Company from transferring assets to the Aladdin Cobalt, Ltd. This action was taken in the interests of minority shareholders who did not desire to have their stock transferred at the ratio of 20 dollar shares of Chambers-Ferland for one pound share of Aladdin Cobalt, Ltd. Since the action was entered there has been heavy buying of the stock for the Aladdin Cobalt, and it is not thought likely that any immediate attempt will be made to force through the wishes of the majority shareholders.

Nipissing.—Production from Nipissing during the month of March, despite the fact that the low grade mill was only running three weeks of the month, amounted to \$169,079, or more than enough to meet all dividend requirements. In development work several stringers have been found of the big vein 64. These stringers are all narrow and low grade, but are sufficiently encouraging to develop. It is interesting to notice that from shaft 150 it is believed that the extension of the Seneca vein has been picked up. Where it has been cut this vein is of calcite and low in silver. A raise is being started on it.

Pumping out of Kerr Lake has begun again. The water has all been drained off and the scow upon which the pumps are mounted has been moved about 60 ft. The pumps are already at work sucking out the mud from the bottom. Everything is ready to commence operations at Cobalt Lake, and the work of de-watering the lake will not now be long delayed.

Temiskaming and Hudson Bay Co. has an option on the Wright claims in southeast Coleman, and it is expected that work here will commence soon as air is now available for all requirements.

Dome.—The March production at the Dome will be about \$95,000 and the grade will run about \$4.14.

A radical change is to be made in the method of breaking and hauling ore underground. At the 425 ft. level of the No. 2 shaft the biggest crusher ever installed underground for this class of work has been ordered. It will crush to five inch. The crushed ore will then pass over a grizzly and the over size will be treated in a secondary crushing plant before going to the stamps. The ore will then be shot into a 500 ton ore pocket. The ore will be collected from the various stopes by electric storage battery locomotives hauling trains of cars carrying five tons.

A great increase in efficiency in underground transportation has been made by the substitution of one large car for several small ones. The ore chutes have also been widened so that the big slabs of ore will not stick and necessitate breaking in the chutes. The crushing underground will still further facilitate the handling of the ore from the chutes. Costs, by these changes in transportation alone, have been reduced ten cents a ton.

There is not likely to be any addition to the actual milling plant of the Dome for some time to come; but greater efficiency is causing the material increase in tonnage from month to month. Like all other properties in the camp the Dome had to start up its steam plant while the power was short; but it has now been closed down again.

Miller-Middleton—Within a few weeks the Miller-Middleton claims will be linked up with the general system of the Hollinger and operations upon these properties of the Canadian Mining & Finance Co. will commence. So far, beyond some surface stripping and the sinking of a shaft to the 200-ft. level, little development has taken place here. A crosscut from the nearest drift of the Hollinger has been run at the 425 ft. level and is now within 200 ft. of its objective. A raise will then be put through to connect with the old shaft.

Vipond—Diamond drilling has commenced on the Porcupine Vipond at the 300 ft. level. Flat holes will be put on both from the west and east faces of the drift on the Davidson vein to discover the trend of the vein and obtain other data. The vein is taking a turn and it is believed that its future course can be more easily ascertained with the diamond drill than with a continuance of the drift.

The Vipond mill is now running very satisfactorily. For the first three months of the year the clean up amounted to \$77,000 and the costs to \$5 a ton. The heads were well up to the average for the Pearl Lake section of the camp, so that a good profit is being obtained.

North Thompson—Work is to be resumed on the North Thompson claims by the Huronian Belt Co. A working shaft of three compartments is to be sunk to the 300 ft. level and a contract has been let for the work, which will commence very shortly. For some months now the Porcupine Vipond has been using the steam plant of the North Thompson.

Porcupine Imperial has bought some machinery and will open up their old workings in Deloro in a month or two.

McIntyre—Diamond drilling on the No. 5 vein system of the McIntyre is still meeting with the most gratifying success. More recent operations cut the contact vein at the 500 ft. level, where it shows a width of seven ft. of twelve dollar ore. Profiting by the data obtained from the drill hole, a flat hole was started with the object of picking up the same vein on the 400 ft. level and it has now been located.

It shows in the core as 7 ft. wide and of a good grade of ore. The diamond drill has now been moved to the 300 ft. level where the location of the vein at that level will be attempted. The tonnage treated and consequently the production for the month of April is not likely to increase, as the ore in some of the stopes is wet from surface water and crushing is more difficult.

Porcupine Crown—A remarkable extraction is being obtained by the decantation process at the Porcupine Crown mill. Only 27 cents is in the tails and the extraction is 98.6 per cent. It has now been resolved to retreat the old tails that were banked from the old amalgamation plant. The capacity of the cyanide plant is larger than that of the crushing end and the treatment can be made without any interference with the ordinary course of development of the mine.

BRITISH COLUMBIA

Cariboo in the Sixties.—Occasionally reminder is given that it is more than half a century since metalliferous mining was commenced in British Columbia by the reprinting in the Victoria Daily Colonist of news items taken from its issue of fifty years ago. One that appeared on April 16 follows: "Assay office in Cariboo. Mr. Edwin Russell, of the Bank of British Columbia, left yesterday for the mainland and he will assume the managership of the bank at Richfield. He is taking with him an experienced assayer who will spend considerable time in examining the mineral wealth of that district." Richfield was on Williams creek, about a mile or so from the town of Barkerville Bancroft said, in his "History of British Columbia:" "Toward the close of the season of 1861, all previous discoveries were exceeded by the developments in the rich ground lying 50 or 60 ft. under the flat below 'the canyon.' To the Barker Company belongs the credit of having sunk the first paying shaft into the new deposit, and in honor of this event the nucleus of a town creek, about a mile or so from the town of Barkerville. Supported by the underground mining, the town grew rapidly in population and maintained for years the position of the principal town in Cariboo. (It was destroyed by fire in the summer of 1868, but by the end of September forty new buildings had risen.) The Diller Company were among the next in order to bottom a shaft into deep ground, washing out in one day, it is said 200 lb. of gold (Worth, at \$16 an oz., \$34,400.) Large as was the yield of 1862, the following season proved even more prosperous, and received the appellation of 'the golden year.' According to Macfie, the creek was then worked over an area of seven miles, and of the numerous claims about 40 yielded handsomely, while about 20 produced steadily between 70 and 400 oz. a day. Palmer states that the chief owner of the Cameron claim went home with \$150,000 saved by him in one year."

The foregoing digression is ended with the mention of Cameron for the reason that it is quite likely there are to-day living in Ontario readers of the Canadian Mining Journal who remember the home-coming of Cameron (was it not to Cornwall or its neighborhood.) Again, in 1885-1886 Mr. J. McEvoy assisted Mr. Amos Bowman in his geological investigations and other preparations for an official report and maps of the world-famed Cariboo gold-diggings. It is of interest to note that gold-milling was commenced in a small way at Richfield in 1876, and that was probably the earliest milling of metalliferous ore done in British Columbia. Coming down to the present, Mr. John Hopp continues to work on a fairly large scale placer-gold properties on or near Williams creek, and it is also noteworthy that during the last two field-work seasons the work of testing the flats adjacent to the lower portions of Williams creek has been in progress, boreholes having been sunk by means of a Keystone drill, and that the test work is to be continued this season, the object being to determine whether or not the gravels contain gold in sufficient quantity to warrant gold-dredging on an important scale being undertaken here.

A rough estimate of the value of the gold taken from the Cariboo district in all years to the end of 1914 places the total at approximately \$42,000,000. How much gold is still contained in the enormous quantities of gravels known to occur in the district, and largely unworked, can only be guessed. With railway transportation now being provided, and if capital be made available for systematic operations with modern gold-

saving appliances, there is little doubt that the Cariboo district will be productive for many years to come.

East Kootenay.

Ore Production Larger.—A comparison of the output of the metalliferous mines of Fort Steele mining division of East Kootenay district shows a considerable increase for the first quarter of 1915 as compared with the corresponding period of 1914. During thirteen weeks of the current year, ended April 1, the total quantity of ore received at the Consolidated Co's smelting works at Trail from East Kootenay was 10,502 tons, all of which was from the company's Sullivan Group mines. This compares with 4,609 tons in the first quarter of 1914, including 246 tons from the company's St. Eugene mine, the remainder having been Sullivan ore.

Coal Mining Outlook.—District newspapers state that the outlook for an enlarged demand for coal is promising. It has been announced that instead of obtaining coal for its Manitoba division lines from the United States, the Canadian Pacific railway will use coal from southern Alberta and the Crowsnest district of Southeast Kootenay, British Columbia. A published report places the amount of coal, additional to past requirements, that the C. P. R. will need for its Manitoba system west of Winnipeg at about 2,000 tons a day. While this report has not been officially confirmed, it is of interest to know that in the districts directly interested confidence prevails that the demand for coal will be larger and that consequently coal-miners will not lose so much time this year, by reason of lack of orders for coal, as they were unfortunately compelled to do last year.

West Kootenay.

Slocan.—A report has been published in Spokane, Washington, in effect that the superintendent of the Rambler-Cariboo mine, in McGuigan basin, had advised the directors of the Rambler-Cariboo Mines, Ltd., in which city is situated the head office of the company, that a shoot of high-grade silver-lead ore the existence of which was not previously known, had recently been found on the 900-ft. level of the mine. Generally favorable accounts of progress at the Rambler-Cariboo mine and concentrator have been received, a considerable improvement having been effected all round since the appointment of Mr. W. A. Cameron as superintendent. During 14 weeks of the current year, ended April 8, the total quantity of crude ore and concentrate received at Trail from this mine was 605 tons. Figures given by the Daily News, Nelson, show that in January and February 172 tons of zinc concentrate was shipped from the Rambler-Cariboo mill to the United States. The Slocan Record, New Denver, states that Mr. Cuning, of Sandon, intends to resume development of the Mercury claim; also that work has been discontinued at the Payne mine, near Sandon, following the occurrence of a fire at the office, in Spokane, of those who have been developing the property at depth, under an option to purchase. Ore running 300 oz. of silver to the ton is being stoped in the Molly Hughes mine, near New Denver; the shoot of good ore is about 10 in. wide. Bids are being invited for doing 150 ft. of underground work on the Hartney, on Silver mountain, near New Denver. Ore is reported to have been encountered in the lower adit of the Echo, situated above the Standard mine, in Silverton camp.

Nelson.—Attention having lately been drawn to the occurrence of molybdenite near Salmo, which is in this mining division, the following excerpt from an official bulletin, issued early in the current year by the British

Columbia Department of Mines, may be of interest: "The mineral molybdenite has been discovered in what appears to be commercial quantity, at the head of Lost creek, some 15 miles from the town of Salmo, and two earloads of the mineral has been mined and taken to Salmo for shipment. The deposit would appear to be of considerable size, but, judging from the samples sent to this Department by the owners, the material will require to be concentrated to bring it up to the market requirements of about 85 per cent. molybdenite." It is known that one lot of 15 tons shipped to the United States for test treatment yielded about 11 per cent. molybdenite. This was probably selected ore. As yet, however, no considerable development of the deposit has taken place, so it is, perhaps, too soon to judge of its commercial importance. As the mineral is found in a number of places on the group of claims, though not in all of them in such quantity as where shipment was made from, it is evident that much more exploration and development must be done before an adequate idea of the commercial value of the deposit can be obtained.

Boundary.

Phoenix.—Diamond drilling was resumed on the Granby's property here on April 3 by Mr. Page Boyles, the diamond-drill contractor, who on that date reached Phoenix from Spokane.

Samples of good ore have been received in Grand Forks from the Gloster claim, in Franklin camp, North Fork of Kettle river. The ore contains copper and silver. The orebody was reached by a 90-ft. adit which intersects a vein four ft. in width.

A report is current and given credence that a shoot of ore of good grade, encountered some time ago when diamond-drilling in the British Columbia Copper Co's Mother Lode mine near Greenwood, is to be mined and that the ore will probably be smelted at the Granby Co's smeltery at Grand Forks. Confidence is felt at Greenwood that operation will be resumed at that mine shortly.

Gold Receipts.—Published figures, showing gold receipts at the Dominion of Canada Assay Office at Vancouver, British Columbia, during the fiscal year ended March 31, indicate that there was a considerable increase as compared with those for the corresponding period ended March 31, 1914. The number of deposits was 1,283 against 808 for the preceding year, which gives an increase in number of 475 deposits. The weight of the gold received was 169,834.26 troy oz. against 118,286.48 for the year before, an increase of 51,547.78 troy oz. The net value of the gold received was \$2,105,136.12, as compared with \$1,456,468.70, an increase in value of \$648,667.42. While particulars of the sources of the gold received last year have not been obtained, it is known that about one-half of the total was from British Columbia mines, and the greater part of the other half from Yukon Territory. Receipts for the calendar year 1914 were not so large as those for the last fiscal year, as stated above. The figures for the calendar year were: Number of deposits, 1,115; weight of gold in Troy ozs., 166,150 oz; net value, \$2,029,500. These figures show increases over those for the calendar year 1913, as follows: In number of deposits, 332; in weight of gold, 54,650 troy ozs; in net value, \$580,785.

Dividends.—During the first quarter of the current year three metalliferous mining companies operating in British Columbia have declared dividends, namely the Consolidated Mining and Smelting Co., the Hedley Gold Mining Co., and the Le Roi No. 2 Ltd. That of the Consolidated Co. was Dividend No. 16, at the rate of two per cent. for the quarter or eight per cent. per annum on its issued capital; total amount of the

dividend, \$116,098; payable on April 1. That of the Hedley Co. was of three per cent. on its issued capital of \$1,200,000; and a bonus of two per cent., together five per cent. total amount of dividend \$60,000; payable March 31. That of the Le Roi No. 2, Ltd., was of one shilling a share on its 120,000 shares; total amount of dividend £6,000; payable May 1. Le Roi No. 2 directors receive an allowance of 5 per cent. on amount of dividends paid, so that £300 has to be added, which brings the total of this dividend disbursement up to £6,300, or approximately \$30,681.

SETTLEMENTS FOR SILVER AND LEAD IN BRITISH COLUMBIA.

The Kootenaian, Kalso British Columbia, has published information relative to "improved terms of settlement" for silver and lead contained in ores, as offered by the Consolidated Mining and Smelting Co. on ores shipped to its smeltery at Trail. The Kootenaian says, in part: It is stated that the metal markets having become more nearly normal, although still affected somewhat by war conditions, and that the Consolidated Co., owing to the manufacture in Canada of shrapnel shells for the British Government has been able to market its lead, the company is once more in a position to receive silver-lead ores, and to settle for them in the ordinary way. The changed conditions necessitate some alterations in rates, which the smeltery officials claim do not affect shippers adversely, but provide what is likely to be a more permanent basis of settlement.

The new basis of settlement provides that payment for silver will be made at 95 per cent. of the fire assay at the New York quotation, as before. Payment for lead will be at 90 per cent. of the fire assay at the Montreal competitive price less one cent and a half a lb. Quotations used in settlement for both silver and lead will be the average of the second month following the date of receipt of the ore at the smeltery. Rates for treatment will be similar to those that prevailed prior to August 1, 1914. The customary advance to shippers will be made, shortly after sampling, of 90 per cent. of the estimated value on quotations current at the date of receipt of ore at the smeltery; the balance will be adjusted as soon as shall be practicable after the close of the second month following the date of receipt.

With respect to the Montreal price for lead—this is to be made up daily by Messrs. Thos. Robertson & Co., Ltd., of Montreal, by adding to prices current in St. Louis, London, or other competitive market, the freight, duty, wharfage, and insurance which an importer from such market would be obliged to pay, whichever provides the lowest price paid down in Montreal.

These new terms were to become effective upon ore received at Trail on April 1, 1915, and thereafter.

COPPER PRODUCTION ON BRITISH COLUMBIA COAST.

The recent visit to British Columbia of Mr. David Carnegie, Dr. A. W. G. Wilson, and Dr. A. Stansfield, and their enquiries relative to matters bearing on a suggested establishment of a copper refinery in that province, have directed attention to the production of copper in Western Canada. In this connection, it is of interest to note that on March 1, in the course of an address to a meeting of the Western Branch of the Canadian Mining Institute held in Victoria on that

date, Sir Richard McBride, premier and minister of mines for British Columbia, said:

"Now I come to deal more particularly with the Coast district mineral production, and here the most noteworthy feature is the large increase in copper production, as indicated in the following figures:

	lbs.
"During the last five years the total copper production on the lower Coast amounted to	57,020,627
Ditto in Portland Canal Skeena, and Queen Charlotte mining divisions	11,240,104

Making a total of 68,260,731 from this section of the province, which only serves to emphasize what I said in my opening observations as to the future of this portion of British Columbia.

"Of the total production of copper in the Coastal districts during the last five years, 36 per cent. was produced in 1914, in which year the output was more than 50 per cent. larger than in any other year since a beginning was made to produce copper from mines in this district. It should be noted that nearly all of the 1914 production was made at two mines—the Britannia, near Vancouver, and the Hidden Creek, on Observatory inlet. Neither of these mines, however, was worked to capacity last year, war conditions having prevented, so that when normal conditions shall be restored it will not be unreasonable to expect an output from them of 40,000,000 to 45,000,000 lbs. of copper a year, without including the output of several much smaller mines that will probably also be producers in the near future."

Particulars of production in the Coastal district for the five-year period above referred to are given in the table that follows. It should be kept in mind that the figures for 1914 are estimated; also that the statistics of the British Columbia Department of Mines usually show a somewhat larger production than do those of the Dominion Department of Mines. The British Columbia figures for the Coast and Cassiar districts are as under:

	Portland Canal Skeena, Queen Charlotte, Total. etc.	
	lbs.	lbs.
For 1910.	3,078,090	3,078,090
For 1911.	10,998,721	19,151 11,017,872
For 1912.	15,429,778	88,403 15,518,181
For 1913.	14,443,793	3,174 14,446,967
For 1914.	13,070,245	11,129,376 24,199,621
Totals.	57,020,627	11,240,104 68,260,731

Those interested in the copper production of British Columbia and to whom the Transactions of the Canadian Mining Institute are accessible may find in Vol. XVI, 1913, on pp. 576-583, particulars of the industry to the end of 1912. The total quantity of copper produced in the province in all years, as shown in the official records of the British Columbia Department of Mines, was 503,737,902 lbs. Of that total approximately 65,251,000 lbs. was from what is officially known as the Coast district, and 1,721,000 lbs. from mining divisions included, officially, in Cassiar district. If there be added to the total of the whole province the production of 1913 and 1914 say 91,460,000 lbs. a grand total for all years of, in round figures, 595,198,000 lbs. will be obtained. It is noteworthy that more than 50 per cent. of that total was the production of seven years, 1908-1914.

MARKETS

STOCK QUOTATIONS.

(Courtesy of J. P. Bickell & Co., Standard Bank Building, Toronto.)

New York Curb Stocks.

	April 22, 1915.	
	Bid	Ask
Alaska Gold	...	.40
British Copper	.00 $\frac{3}{4}$	.01
Braden Copper	.08 $\frac{3}{8}$	.08 $\frac{1}{2}$
California Oil	293.00	295.00
Chino Copper	.46 $\frac{7}{8}$	.47 $\frac{1}{4}$
Giroux Copper	.00 $\frac{1}{2}$	.01
Green Can	.34	.35
Granby	.89	.90
Miami Copper	.26 $\frac{1}{4}$	.26 $\frac{1}{2}$
Nevada Copper	.15 $\frac{1}{8}$	.15 $\frac{1}{4}$
Ohio Oil	130.00	140.00
Ray Cons. Copper	.24 $\frac{1}{8}$	.24 $\frac{3}{8}$
Standard Oil of New York	189.00	191.00
Standard Oil of New Jersey	390.00	392.00
Standard Oil (old)	1395.00	...
Standard Oil (subs)	895.00	...
Tonopah Mining	.07 $\frac{1}{8}$	.07 $\frac{3}{8}$
Tonopah Belmont	.04	.04 $\frac{1}{4}$
Tonopah Merger	.39	.41
Inspiration Copper	.32	.32 $\frac{1}{4}$
Goldfield Cons.	.01 $\frac{1}{2}$	.01 $\frac{3}{8}$
Yukon Gold	.02 $\frac{7}{8}$	.03

Porcupine Stocks.

	Bid	Ask
Apex	.04 $\frac{1}{8}$	.04 $\frac{1}{4}$
Dome Extension	.10 $\frac{1}{4}$	.10 $\frac{1}{2}$
Dome Lake	.18	.20
Dome Mines	13.40	13.70
Foley O'Brien	.28	.34
Hollinger	23.50	24.00
Jupiter	.13 $\frac{1}{4}$	.13 $\frac{1}{2}$
McIntyre	.50	.51
Pearl Lake	.01 $\frac{3}{8}$	.02
Porcupine Gold	.00 $\frac{1}{2}$	.00 $\frac{3}{4}$
Imperial	.05 $\frac{1}{2}$	.05 $\frac{3}{4}$
Preston East Dome	.02 $\frac{3}{4}$	.03 $\frac{1}{8}$
Rea	...	.12
West Dome (new stock)	.04 $\frac{7}{8}$	.05 $\frac{1}{8}$
Porcupine Crown	.81	.84
Porcupine Vipond	.58	.60

Cobalt Stocks.

	Bid	Ask
Bailey	.02 $\frac{7}{8}$	.03
Beaver	.38	.40
Buffalo	.50	.70
Chambers Ferland	.22	.23
Coniagas	4.70	5.00
Crown Reserve	.88	.96
Foster	.03	.04
Gifford	.02 $\frac{1}{4}$	.02 $\frac{3}{8}$
Gould	.00 $\frac{1}{4}$	.00 $\frac{3}{4}$
Great Northern	.03	.03 $\frac{1}{2}$
Hargraves	.01 $\frac{1}{4}$	.01 $\frac{1}{2}$
Hudson Bay	.17	.19
Kerr Lake	4.85	5.00
La Rose	.50	.58

McKinley	.30	.35
Nipissing	6.05	6.10
Peterson Lake	.22	.24
Right of Way	.05 $\frac{1}{4}$	.05 $\frac{1}{2}$
Leaf	...	.02 $\frac{1}{2}$
Silver Queen	...	.02 $\frac{1}{2}$
Temiskaming	.42 $\frac{1}{2}$	.43
Trethewey	.12 $\frac{1}{2}$	.15 $\frac{1}{2}$
Wettlaufer	.04	.05
Seneca Superior	1.30	1.35
Teck Hughes	.04	.05

TORONTO MARKETS.

April 23—(Quotations from Canada Metal Co., Toronto)—
 Spelter, 13 cents per lb.
 Lead, 5 $\frac{1}{2}$ cents per lb.
 Tin, 56 cents per lb.
 Antimony, 25 cents per lb.
 Copper casting, 18 $\frac{1}{2}$ cents per lb.
 Electrolytic, 18 $\frac{1}{2}$ cents per lb.
 Ingot brass, yellow, 10c.; red, 12 cents per lb.
 April 23—(Quotations from Elias Rogers Co., Toronto)—
 Coal, anthracite, \$8.00 per ton.
 Coal, bituminous, \$5.25 per ton.

NEW YORK MARKETS.

April 21—Connellsville coke (f.o.b. ovens)—
 Furnace coke, prompt, \$1.55 to \$1.65 per ton.
 Foundry coke, prompt, \$2.00 to \$2.50 per ton.
 April 21—Tin, straits, 44.00 cents.
 Copper, Prime Lake, 17.75 to 18.00 cents.
 Electrolytic copper, 17.50 to 17.62 $\frac{1}{2}$ cents.
 Copper wire, 18.75 cents.
 Lead, 4.20 cents.
 Spelter, 12 to 12.25 cents.
 Sheet zinc (f.o.b. smelter), 13.50 cents.
 Antimony, Cookson's, 32.00 to 33.00 cents.
 Aluminum, 18.75 cents.
 Nickel, 42.00 to 45.00 cents.
 Platinum, soft, \$40.00 per ounce.
 Bismuth, \$2.75 to \$3.00 per pound.
 Quicksilver, \$65.00 per 75-lb. flask.

SILVER PRICES.

April—	New York cents.	London pence.
7	50 $\frac{1}{4}$	23 $\frac{3}{4}$
8	50 $\frac{1}{4}$	23 $\frac{5}{8}$
9	50 $\frac{1}{8}$	23 $\frac{5}{8}$
10	50 $\frac{1}{8}$	23 $\frac{5}{8}$
12	50 $\frac{1}{8}$	23 $\frac{5}{8}$
13	49 $\frac{7}{8}$	23 $\frac{1}{2}$
14	49 $\frac{7}{8}$	23 $\frac{1}{2}$
15	50	23 $\frac{1}{16}$
16	49 $\frac{7}{8}$	23 $\frac{1}{2}$
17	50	23 $\frac{1}{16}$
19	50 $\frac{3}{8}$	23 $\frac{3}{4}$
20	50 $\frac{3}{8}$	23 $\frac{3}{4}$
21	50 $\frac{1}{2}$	23 $\frac{1}{8}$
22	50 $\frac{1}{2}$	23 $\frac{1}{8}$

PROFESSIONAL DIRECTORY.

The very best advice that the publishers of the Canadian Mining Journal can give to intending purchasers of mining stock is to consult a responsible Mining Engineer BEFORE accepting the prospectus of the mining company that is offered them. We would also strongly advise those who possess properties that show signs of minerals not to hesitate to send samples and to consult a chemist or assayer. Those who have claims and who require the services of a lawyer, with a thorough knowledge of Mining Law, should be very careful with whom they place their business.

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PUBLICATIONS

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Most of the older reports are out of print, but they may usually be found in public libraries, libraries of the Canadian Mining Institute, etc.

REPORTS RECENTLY ISSUED:

CANADA

Summary Report of the Geological Survey for the year 1913.

NEW BRUNSWICK and NOVA SCOTIA

Memoir 20. Gold fields of Nova Scotia, by W. Malcolm.

Memoir 60. Arisaig-Antigonish District, Nova Scotia, by M. Y. Williams.

Memoir 41. The "Fern Ledges" Carboniferous flora of St. John, New Brunswick, by Marie C. Stopes.

QUEBEC

Museum Bulletin No. 3. The Anticosti Island faunas, by W. H. Twenhofel.

Memoir 39. Kewagama Lake Map-Area, Quebec, by M. E. Wilson.

ONTARIO

Museum Bulletin No. 5. A Beatricea-like Organism from the Middle Devonian, by Percy E. Raymond.

Memoir 40. The Archaean Geology of Rainy Lake Re-studied, by Andrew C. Lawson.

Museum Bulletin No. 8. The Huronian Formations of Timiskaming Region, Canada, by W. H. Collins.

NORTH-WEST PROVINCES

Memoir 47. Clay and Shale Deposits of the Western Provinces, Part 3, by Heinrich Ries.

Memoir 53. Coal Fields of Manitoba, Saskatchewan, Alberta and Eastern British Columbia (Revised Edition) by D. B. Dowling.

Museum Bulletin No. 4. The Crowsnest Volcanics, by J. D. MacKenzie.

Memoir 61. Moose Mountain District, Southern Alberta (Second Edition), by D. D. Cairnes.

BRITISH COLUMBIA

Memoir 32. Portions of Portland Canal and Skeena Mining Divisions, Skeena District, B.C., by R. G. McConnell.

Memoir 51. Geology of the Nanaimo Map-Area, by C. H. Clapp.

Memoir 55. Geology of Field Map-Area, B. C., and Alberta, by John A. Allan.

YUKON AND NORTH-WEST TERRITORIES

Memoir 31. Wheaton District, Yukon Territory, by D. D. Cairnes.

MAPS RECENTLY ISSUED:

CANADA

Map 91A. Geological map of the Dominion of Canada and Newfoundland. Scale 100 miles to 1 inch.

NEW BRUNSWICK AND NOVA SCOTIA

Map 27A. Bathurst and vicinity, Gloucester County, New Brunswick. Geology.

Map 39A. Geological Map of Nova Scotia.

Map 121A. Franey Mine and Vicinity, Victoria County, N.S.

QUEBEC

Map 95A. Broadback River, Mistassini territory, Quebec. Geology.

Map 100A. Bell River, Quebec. Geology.

ONTARIO

Map 124A. Wanapitei (Falconbridge, Street, Awrey, and Parts of MacLennan and Scadding Townships), Sudbury District, Ont. Geology.

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NORTH-WEST PROVINCES

Map 55A. Geological map of Alberta, Saskatchewan, and Manitoba.

BRITISH COLUMBIA

Map 43A. Sooke Sheet, Vancouver Island, British Columbia. Topography.

Map 136A. Hazelton-Aldermere, Cassiar and Coast Districts, British Columbia.

1321. Diagram Showing the Geology of Texada Island, British Columbia.

Map 106A. Groundhog coal field, British Columbia. Geology.

YUKON AND NORTH-WEST TERRITORIES.

Map 113A. Canadian routes to White River District, Yukon, and to Chisana District, Alaska.

Map 58A. Explored Routes in the Lower Parts of the Drainage Area of Churchill and Nelson Rivers, Manitoba and Saskatchewan. Geology.

NOTE.—Maps published within the last two years may be had, printed on linen, for field use. A charge of ten cents is made for maps on linen.

The Geological Survey will, under certain limitations, give information and advice upon subjects relating to general and economic geology. Mineral and rock specimens, when accompanied by definite statements of localities, will be examined and their nature reported upon. Letters and samples that are of a Departmental nature, addressed to the Director, may be Mailed O.H.M.S. free of postage.

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We specialize in explosives for safe coal getting and rock work.

We can give you an explosive which will produce your coal or ore at a minimum cost with a maximum of safety.

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DISTRICT OFFICES:

NOVA SCOTIA:	-	-	-	-	-	-	Halifax
QUEBEC:	-	-	-	-	-	-	Montreal
ONTARIO:	Toronto,	Cobalt,	South Porcupine,	Port Arthur,	-	-	Kingston
MANITOBA:	-	-	-	-	-	-	Winnipeg
ALBERTA:	-	-	-	-	-	-	Edmonton
BRITISH COLUMBIA:	Vancouver,	Victoria,	Nelson,	-	-	-	Prince Rupert

Factories at

Beloil, P.Q.	Vaudreuil, P.Q.	Windsor Mills, P.Q.
Waverley, N.S.	James Island, B.C.	Nanaimo, B.C.
Northfield, B.C.	Bowen Island, B.C.	Parry Sound, Ont.

The Canadian Miner's Buying Directory.

- Air Hoists—**
Canadian Ingersoll-Rand Co., Ltd.
- Amalgamators—**
Fraser & Chalmers of Canada, Limited.
Northern Canada Supply Co.
- Assayers and Chemists—**
Milton L. Hersey Co., Ltd.
Campbell & Deyell, Cobalt
Ledoux & Co., 99 John St.,
New York
Thos. Heys & Son.
C. L. Constant Co.
- Assayers' and Chemists Supplies—**
C. L. Berger & Sons, 37 William St., Boston, Mass.
Lymans, Ltd., Montreal, Que
Stanley, W. F. & Co., Ltd.
Peacock Bros.
- Ball Mills—**
Fraser & Chalmers of Canada, Limited.
Peacock Bros.
Mussens, Ltd.
- Beams—Steel—**
Dominion Bridge Co.
Mussens, Ltd.
- Belt Tighteners and Clamps—**
Dodge Mfg. Co., Ltd.
- Belting—Leather, Rubber and Cotton—**
Mussens, Ltd.
Northern Canada Supply Co.
Jones & Glassco
Federal Engineering Co.
Can. H. W. Johns-Manville Co.
Dodge Mfg. Co., Ltd.
- Blasting Batteries and Supplies—**
Thomas & William Smith
Can. Ingersoll-Rand Co., Ltd.
Curtis & Harvey (Canada) Ltd.
Mussens, Ltd.
Northern Canada Supply Co.
Canadian Explosives, Limited
- Blowers—**
Fraser & Chalmers of Canada, Limited.
Mussens, Ltd.
Northern Canada Supply Co.
- Boilers—**
Mussens, Ltd.
Fraser & Chalmers of Canada, Limited.
Peacock Bros.
Northern Canada Supply Co.
Can. Ingersoll-Rand Co., Ltd.
- Boots—**
Dodge Mfg. Co., Ltd.
- Buckets—**
Hendrick Mfg. Co.
M. Beatty & Sons, Ltd.
Mussens, Ltd.
Northern Canada Supply Co.
- Buildings—Steel Frame—**
Dominion Bridge Co.
- Cable — Aerial and Underground—**
Mussens, Ltd.
Fraser & Chalmers of Canada, Ltd.
Northern Canada Supply Co.
- Cableways—**
Fraser & Chalmers of Canada, Limited.
M. Beatty & Sons, Ltd.
Mussens, Ltd.
- Cages—**
Mussens, Ltd.
Fraser & Chalmers of Canada, Limited.
Jeffrey Mfg. Co.
Northern Canada Supply Co.
- Cables—Wire—**
Northern Electric Co., Ltd.
Standard Underground Cable Co. of Canada, Ltd.
- Carbon (Black Diamonds and Bortz)—**
Abe. Levine.
- Cars—**
Jeffrey Mfg. Co.
Mussens, Ltd.
Northern Canada Supply Co.
- Car Pullers—**
Dodge Mfg. Co., Ltd.
- Cement Machinery—**
Northern Canada Supply Co.
Peacock Bros.
- Chains—**
Jeffrey Mfg. Co.
Peacock Bros.
Jones & Glassco
Mussens, Ltd.
Northern Canada Supply Co.
Dodge Mfg. Co., Ltd.
B. Greening Wire Co., Ltd.
- Chain Blocks—**
Mussens, Ltd.
- Chemists**
Canadian Laboratories.
Campbell & Deyell.
Thos Heys & Sons.
Milton Hersey Co.
Ledoux & Co.
- Coal—**
Dominion Coal Co.
Nova Scotia Steel & Coal Co.
- Coal Cutters—**
Jeffrey Mfg. Co.
Sullivan Machinery Co.
Can. Ingersoll-Rand Co., Ltd.
Peacock Bros.
Mussens, Ltd.
- Coal Mining Exposives—**
Curtis & Harvey (Can.), Ltd.
Canadian Explosives, Limited
- Coal Mining Machinery—**
Mussens, Ltd.
Can. Ingersoll-Rand Co., Ltd.
Fraser & Chalmers of Canada, Limited.
Peacock Bros.
Jeffrey Mfg. Co.
- Coal Punchers—**
Sullivan Machinery Co.
Can. Ingersoll-Rand Co., Ltd.
Mussens, Ltd.
- Coal Washeries—**
Jeffrey Mfg. Co.
Mussens, Ltd.
Peacock Bros.
- Collars—**
Dodge Mfg. Co., Ltd.
- Compressors—Air—**
Fraser & Chalmers of Canada, Limited.
Sullivan Machinery Co.
Can. Ingersoll-Rand Co., Ltd.
Mussens, Ltd.
Peacock Bros.
Northern Canada Supply Co.
- Concentrators and Jigs—**
Fraser & Chalmers of Canada, Limited.
James Ore Concentrator Co.
Mussens, Ltd.
- Concrete Mixers—**
Mussens, Ltd.
Peacock Bros.
Northern Canada Supply Co.
- Condensers—**
Fraser & Chalmers of Canada, Limited.
Smart-Turner Machine Co.
Peacock Bros.
Northern Canada Supply Co.
- Conveyors—Belt—**
Mussens, Ltd.
Boving & Co. of Canada, Ltd.
- Converters—**
Fraser & Chalmers of Canada, Limited.
Jeffrey Mfg. Co.
Northern Canada Supply Co.
Peacock Bros.
Mussens, Ltd.
- Conveyor—Trough—Belt—**
Hendrick Mfg. Co.
- Couplings—**
Dodge Mfg. Co., Ltd.
Boving & Co. of Canada, Ltd.
- Cranes—**
Smart-Turner Machine Co.
Peacock Bros.
Mussens, Ltd.
M. Beatty & Sons, Ltd.
Boving & Co. of Canada, Ltd.
- Cranes—Electric—**
Mussens, Ltd.
- Cranes—Overhead Traveling—**
Mussens, Ltd.
Boving & Co. of Canada, Ltd.
- Crane Ropes—**
Mussens, Ltd.
Allan, Whyte & Co.
Thos. & Wm. Smith.
B. Greening Wire Co., Ltd.
- Crushers—**
Fraser & Chalmers of Canada, Limited.
Peacock Bros.
Lymans, Ltd.
Mussens, Ltd.
Hadfields Steel Foundry Co.
- Cyanide Plants—**
Fraser & Chalmers of Canada, Limited.
Roessler & Hasslacher.
Thos. & Wm. Smith.
Peacock Bros.
- Derricks—**
Smart-Turner Machine Co.
S. Flory Mfg. Co.
M. Beatty & Sons, Ltd.
Mussens, Ltd.
- Diamonds (for Diamond Drills)—**
Abe. Levine.
- Diamond Drill Contractors—**
Diamond Drill Contracting Co.
Smith and Travers.
- Dredging Machinery—**
Peacock Bros.
M. Beatty & Sons.
Mussens, Ltd.
Boving & Co. of Canada, Ltd.
- Dredging Ropes—**
Allan, Whyte & Co.
Fraser & Chalmers of Canada, Limited.
- Drills, Air and Hammer—**
Can. Ingersoll-Rand Co., Ltd.
Mussens, Ltd.
Jeffrey Mfg. Co.
Sullivan Machinery Co.
Peacock Bros.
Northern Canada Supply Co.
- Drills—Core—**
Can. Ingersoll-Rand Co., Ltd.
Standard Diamond Drill Co.
- Drills—Diamond—**
American Diamond Rock Drills.
Sullivan Machinery Co.
Northern Canada Supply Co.
- Drill Steel Sharpeners—**
Can. Ingersoll-Rand Co., Ltd.
Northern Canada Supply Co.
Mussens, Ltd.
- Dump Cars**
Sullivan Machinery Co.
Mussens, Ltd.
- Drills—Electric—**
Mussens, Ltd.
Can. Ingersoll-Rand Co., Ltd.
- Dynamite—**
Curtis & Harvey (Canada), Ltd.
Canadian Explosives.
Northern Canada Supply Co.
- Dynamos—**
Northern Electric Co., Ltd.
- Electric Cranes—**
Mussens, Ltd.
- Ejectors—**
Mussens, Ltd.
Peacock Bros.
Can. Ingersoll-Rand Co., Ltd.
Northern Canada Supply Co.
- Elevators—**
Jeffrey Mfg. Co.
M. Beatty & Sons.
Sullivan Machinery Co.
Northern Canada Supply Co.
Mussens, Ltd.
Peacock Bros.
- Elevator Cups—**
Dodge Mfg. Co., Ltd.
- Engineering Instruments—**
C. L. Berger & Sons.
Peacock Bros.
- Engineers and Contractors—**
Fraser & Chalmers of Canada, Limited.
Roberts & Schaefer Co.
Boving & Co. of Canada, Ltd.
- Engines—Automatic—**
Smart-Turner Machine Co.
Peacock Bros.
- Engines—Gas and Gasoline**
Fraser & Chalmers of Canada, Limited.
Mussens, Ltd.
Alex. Fleck.
Sullivan Machinery Co.
Smart-Turner Machine Co.
Peacock Bros.
- Engines—Haulage—**
Mussens, Ltd.
Fraser & Chalmers of Canada, Limited.
Peacock Bros.
Can. Ingersoll-Rand Co., Ltd.
- Engines—Marine—**
Smart-Turner Machine Co.
Peacock Bros.
- Engines—Oil—**
Peacock Bros.
Boving & Co. of Canada, Ltd.
- Engines—Crude Oil—**
Boving & Co. of Canada, Ltd.
- Engines—Steam—**
Fraser & Chalmers of Canada, Limited.
Smart-Turner Machine Co.
S. Flory Mfg. Co.
Peacock Bros.
M. Beatty & Sons.
Mussens, Ltd.
- Fans—Ventilating—**
Fraser & Chalmers of Canada, Limited.
Sullivan Machinery Co.
Peacock Bros.
Mussens, Ltd.
- Feeders—Ore—**
Fraser & Chalmers of Canada, Limited.
Mussens, Ltd.
- Fixtures—Counter Shaft—**
Dodge Mfg. Co., Ltd.
- Flights—**
Hendrick Mfg. Co.
- Floor Stands—**
Dodge Mfg. Co., Ltd.
- Friction Clutches—**
Dodge Mfg. Co., Ltd.
- Forges—**
Mussens, Ltd.
Northern Canada Supply Co., Ltd.
- Forging—**
M. Beatty & Sons.
Smart-Turner Machine Co.
Peacock Bros.
Boving & Co. of Canada, Ltd.

Continued on page 23.

Canadian Miner's Buying Directory.—(Continued from page 22.)

- Furnaces—Assay—**
Lyman, Ltd.
Mussens, Ltd.
- Furnaces—Electric—**
Boving & Co. of Canada, Ltd.
- Fuse—**
Peacock Bros.
Curtis & Harvey (Canada), Ltd.
Canadian Explosives.
Mussens, Ltd.
Northern Canada Supply Co.
Canadian H. W. Johns-Manville Co., Ltd.
- Gears—**
Smart-Turner Machine Co.
Northern Canada Supply Co.
Boving & Co. of Canada, Ltd.
- Generators—**
Northern Electric Co., Ltd.
Peacock Bros.
- Grease Cups—**
Dodge Mfg. Co., Ltd.
- Hangers—Cable—**
Northern Electric Co., Ltd.
Standard Underground Cable Co. of Canada, Ltd.
Dodge Mfg. Co., Ltd.
- Hand Hoists—**
Boving & Co. of Canada, Ltd.
Fraser & Chalmers of Canada, Limited
- Heaters—Feed Water—**
Mussens, Ltd.
Peacock Bros.
- High Speed Steel Twist Drills—**
Mussens, Ltd.
Northern Canada Supply Co.
- Hoists—Air, Electric and Steam—**
Can. Ingersoll-Rand Co., Ltd.
Peacock Bros.
Mussens, Ltd.
S. Flory Mfg. Co.
Jones & Glassco.
M. Beatty & Sons
Fraser & Chalmers of Canada, Limited
Northern Canada Supply Co.
- Hoisting Engines—**
Peacock Bros.
Mussens, Ltd.
Sullivan Machinery Co.
Fraser & Chalmers of Canada, Limited
Can. Ingersoll-Rand Co.
M. Beatty & Sons.
- Hoists—Gas and Gasoline—**
Mussens, Ltd.
- Hose—**
Canadian H. W. Johns-Manville Co., Ltd.
Mussens, Ltd.
Northern Canada Supply Co.
- Jacks—**
Mussens, Ltd.
Can. Ingersoll-Rand Co., Ltd.
Northern Canada Supply Co.
- Jigs—**
Mussens, Ltd.
Roberts & Schaefer Co.
- Lamps—Acetylene—**
Mussens, Ltd.
Northern Canada Supply Co.
- Lamps—Safety—**
Mussens, Ltd.
Canadian Explosives.
Peacock Bros.
- Link Belt—**
Northern Canada Supply Co.
Jones & Glassco.
- Locomotives—Electric—**
Mussens, Ltd.
Jeffrey Mfg. Co.
- Locomotives—Steam—**
Mussens, Ltd.
- Metal Merchants—**
Henry Bath & Son.
Geo. G. Blackwell, Sons & Co.
Consolidated Mining and Smelting Co. of Canada.
Canada Metal Co.
C. L. Constant Co.
- Monel Metal—**
International Nickel Co.
- Motors—**
Mussens, Ltd.
Northern Electric Co., Ltd.
Peacock Bros.
- Mule Stands—**
Dodge Mfg. Co., Ltd.
- Nickel—**
International Nickel Co.
- Ore Sacks—**
Northern Canada Supply Co.
- Ore Testing Works**
Ledoux & Co.
Can. Laboratories.
Milton Hersey Co., Ltd.
Campbell & Deyell.
- Ores and Metals—Buyers and Sellers of—**
C. L. Constant Co.
Geo. G. Blackwell.
Consolidated Mining and Smelting Co. of Canada.
Orford Copper Co.
Canada Metal Co.
- Perforated Metals—**
B. Greening Wire Co., Ltd.
Fraser & Chalmers of Canada, Limited
Northern Canada Supply Co.
Hendrick Mfg. Co.
- Pick Machines—**
Sullivan Machinery Co.
- Picks—Steel—**
Mussens, Ltd.
Thos. & Wm. Smith.
Peacock Bros.
- Pillow Blocks—**
Dodge Mfg. Co., Ltd.
- Pipes—**
Boving & Co. of Canada, Ltd.
Consolidated M. & S. Co.
Peacock Bros.
Mussens, Ltd.
Northern Canada Supply Co.
Smart-Turner Machine Co.
- Pipe Fittings—**
Can. H. W. Johns-Manville
Mussens, Ltd.
Northern Canada Supply Co.
- Pneumatic Tools—**
Can. Ingersoll-Rand Co., Ltd.
Jones & Glassco.
- Producer—Gas—**
Mussens, Ltd.
- Prospecting Mills and Machinery—**
Standard Diamond Drill Co.
Mussens, Ltd.
Fraser & Chalmers of Canada, Limited
- Pulleys—Iron, Wood Spit, Iron Centre Wood Rim—**
Dodge Mfg. Co., Ltd.
- Pulleys, Shafting and Hangings—**
Fraser & Chalmers of Canada, Limited
Northern Canada Supply Co.
Dodge Mfg. Co., Ltd.
- Pumps—Boiler Feed—**
Boving & Co. of Canada, Ltd.
Mussens, Ltd.
Northern Canada Supply Co.
Peacock Bros.
Canadian Ingersoll-Rand Co. Ltd.
Fraser & Chalmers of Canada, Limited
- Pumps—Centrifugal—**
Boving & Co. of Canada, Ltd.
Mussens, Ltd.
Smart-Turner Machine Co.
Peacock Bros.
Thos. & Wm. Smith.
M. Beatty & Sons.
Can. Ingersoll-Rand Co., Ltd.
Fraser & Chalmers of Canada, Limited
- Pumps—Electric—**
Boving & Co. of Canada, Ltd.
Mussens, Ltd.
Canadian Ingersoll Rand Co., Ltd.
Fraser & Chalmers of Canada, Limited
- Pumps—Pneumatic—**
Mussens, Ltd.
Smart-Turner Machine Co.
Can. Ingersoll-Rand Co., Ltd.
- Pumps—Steam—**
Can. Ingersoll-Rand Co., Ltd.
Mussens, Ltd.
Thos. & Wm. Smith.
Northern Canada Supply Co.
Smart-Turner Machine Co.
- Pumps—Turbine—**
Boving & Co. of Canada, Ltd.
Mussens, Ltd.
Canadian Ingersoll-Rand Co., Ltd.
Fraser & Chalmers of Canada, Limited
- Pumps—Vacuum—**
Smart-Turner Machine Co.
- Quarrying Machinery—**
Mussens, Ltd.
Sullivan Machinery Co.
Can. Ingersoll-Rand Co., Ltd.
- Roasting Plants—**
Fraser & Chalmers of Canada, Limited
- Rolls—Crushing—**
Mussens, Ltd.
Fraser & Chalmers of Canada, Limited
- Roofing—**
Dominion Bridge Co.
Mussens, Ltd.
Northern Canada Supply Co.
Can. H. W. Johns-Manville
- Rope Blocks—**
Mussens, Ltd.
- Rope Wheels—**
Dodge Mfg. Co., Ltd.
- Rope Dressing—**
Dodge Mfg. Co., Ltd.
- Rope—Manilla and Jute—**
Jones & Glassco.
Mussens, Ltd.
Peacock Bros.
Northern Canada Supply Co.
Allan, Whyte & Co.
Thos. & Wm. Smith, Ltd.
- Rope—Wire—**
B. Greening Wire Co., Ltd.
Allan, Whyte & Co.
Northern Canada Supply Co.
Thos. & Wm. Smith.
Fraser & Chalmers of Canada, Limited
Mussens, Ltd.
- Samplers—**
Canadian Laboratories.
C. L. Constant Co.
Ledoux & Co.
Milton Hersey Co.
Thos. Heys & Son.
- Screens—**
B. Greening Wire Co., Ltd.
Mussens, Ltd.
Jeffrey Mfg. Co.
Northern Canada Supply Co.
Peacock Bros.
Fraser & Chalmers of Canada, Limited
- Screens—Cross Patent Flanged Lip—**
Hendrick Mfg. Co.
- Separators—**
Smart-Turner Machine Co.
Peacock Bros.
- Shafting—**
Dodge Mfg. Co., Ltd.
- Sheets—Genuine Manganese Bronze—**
Hendrick Mfg. Co.
- Shovels—Steam—**
Mussens, Ltd.
M. Beatty & Sons.
- Slime Tables—**
James Ore Concentrator.
- Smelting Machinery—**
Mussens, Ltd.
Peacock Bros.
Fraser & Chalmers of Canada, Limited
- Spiral Conveyors—**
Dodge Mfg. Co., Ltd.
- Sprockets—**
Dodge Mfg. Co., Ltd.
- Stacks—Smoke Stacks—**
Canadian H. W. Johns-Manville Co., Ltd.
Hendrick Mfg. Co.
- Stamp Mills—**
Mussens, Ltd.
Peacock Bros.
Fraser & Chalmers of Canada, Limited
- Steel Drills—**
Sullivan Machinery Co.
Mussens, Ltd.
Northern Canada Supply Co.
Can. Ingersoll-Rand Co., Ltd.
Peacock Bros.
Swedish Steel & Imp. Co., Ltd.
- Steel—Tool—**
Mussens, Ltd.
Thos. & Wm. Smith.
N. S. Steel & Coal Co.
Swedish Steel & Imp. Co. Ltd.
- Surveying Instruments—**
Peacock Bros.
W. F. Stanley.
C. L. Berger.
- Switchboards—**
Northern Electric Co., Ltd.
- Take-ups—**
Dodge Mfg. Co., Ltd.
- Tanks—Cyanide, Etc.—**
Mussens, Ltd.
Peacock Bros.
Fraser & Chalmers of Canada, Limited
Hendrick Mfg. Co.
- Tramways—**
Mussens, Ltd.
B. Greening Wire Co., Ltd.
- Transformers—**
Northern Electric Co., Ltd.
Peacock Bros.
- Transits—**
C. L. Berger & Sons.
Peacock Bros.
- Transmission Rope—**
Dodge Mfg. Co., Ltd.
- Trippers—**
Dodge Mfg. Co., Ltd.
- Tube Mills—**
Mussens, Ltd.
Peacock Bros.
Fraser & Chalmers of Canada, Limited
- Turbines—**
Peacock Bros.
Fraser & Chalmers of Canada, Limited
- Turbines—Water—**
Boving & Co. of Canada, Ltd.
- Winding Engines—**
Mussens, Ltd.
Peacock Bros.
Canadian Ingersoll-Rand Co., Ltd.
- Wire Cloth—**
Mussens, Ltd.
Northern Canada Supply Co.
B. Greening Wire Co., Ltd.
- Wire (Bare and Insulated)—**
Northern Electric Co., Ltd.
Standard Underground Cable Co., of Canada, Ltd.
- Zinc Dust—**
Roessler & Hasslacher.

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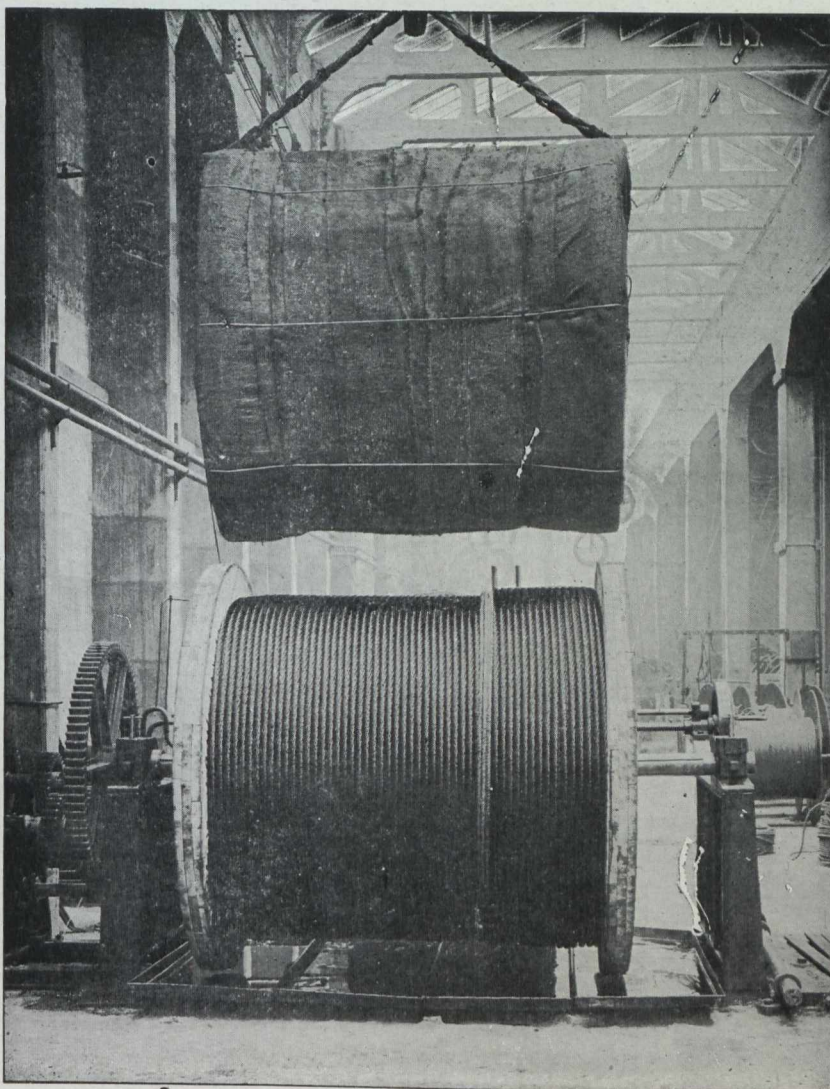
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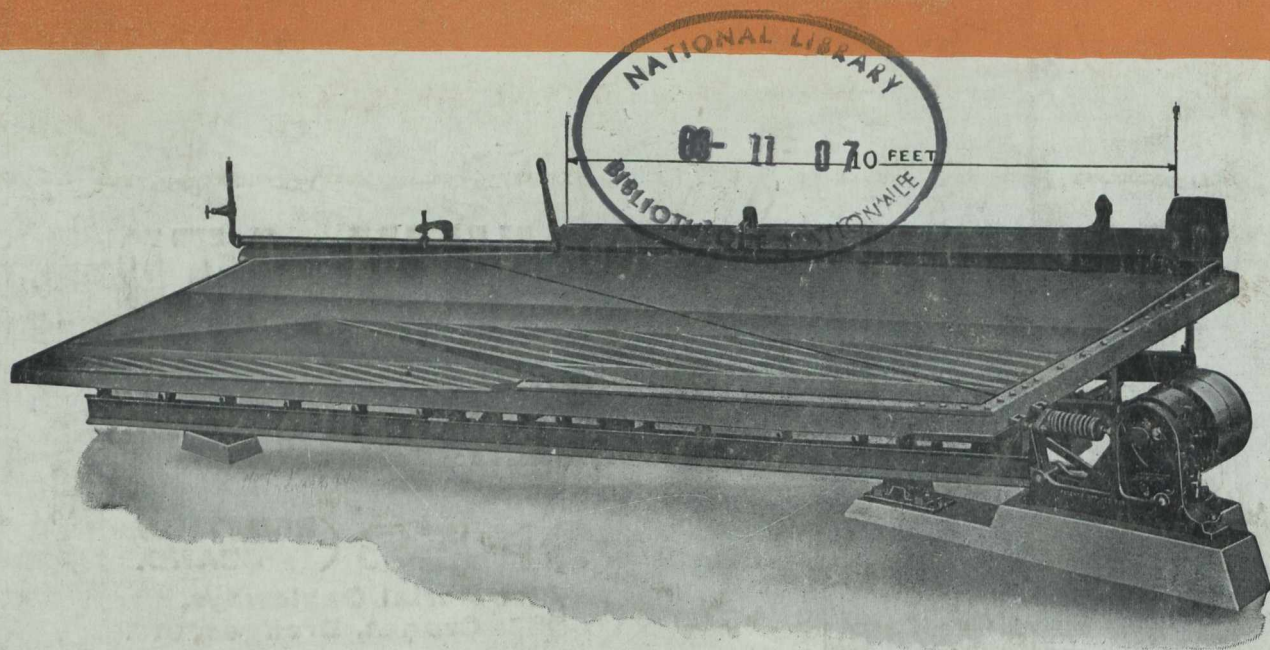
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Hudson Bay Mines, Ltd.	Trethewey Silver	Cobalt Mining Co., Ltd.
Beaver Consolidated Mines, Ltd.		The O'Brien Mines.

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