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AUGUST 1, 1915 Single Copies 15 Cents

CANADIAN MINING JOURNAL

VOL. XXXVI TORONTO No. 15

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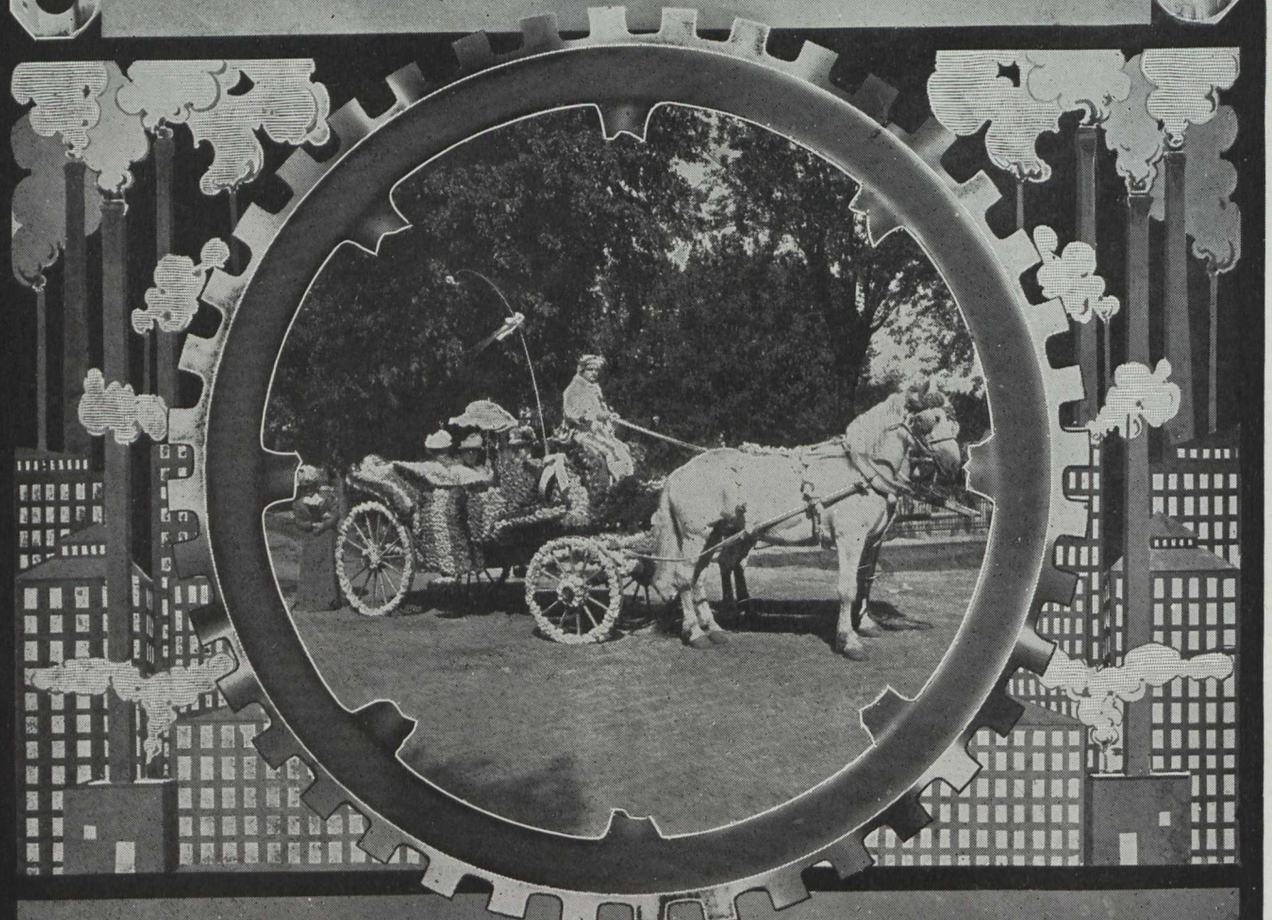

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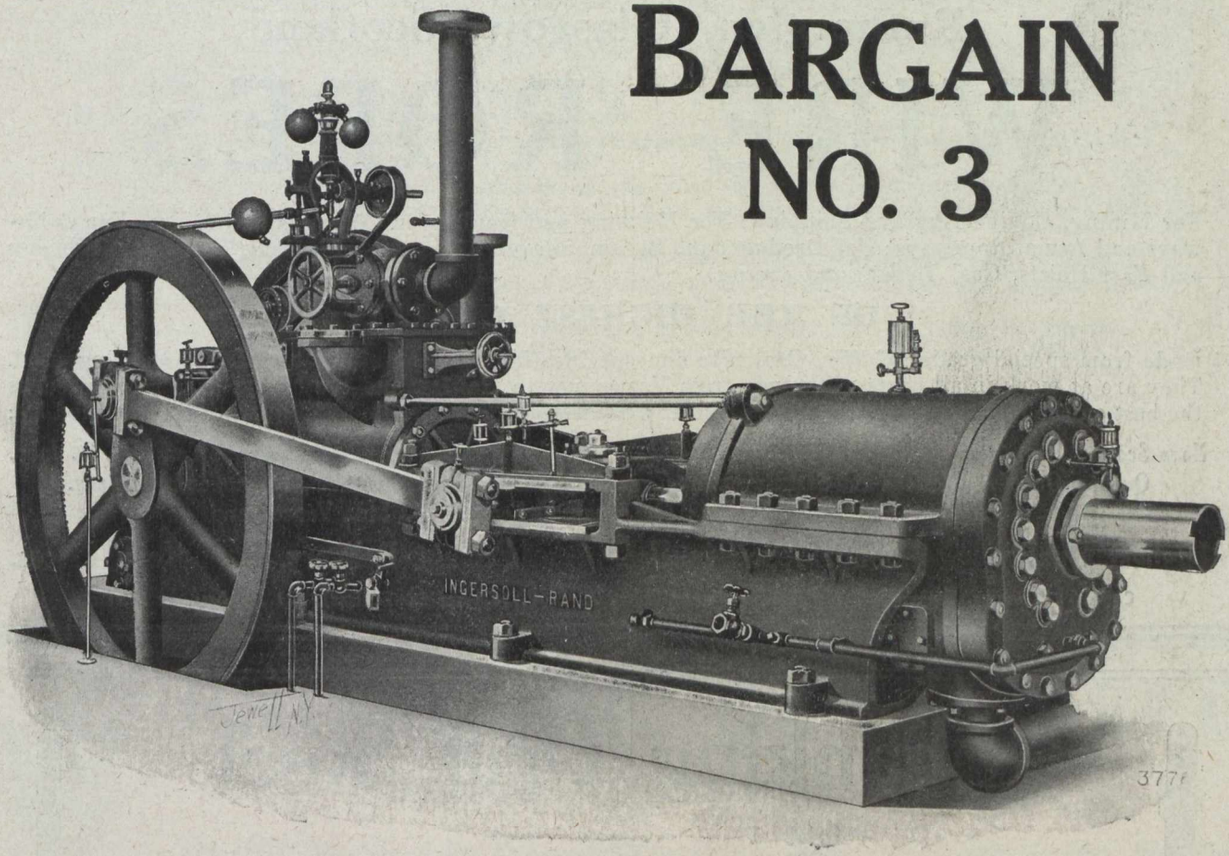

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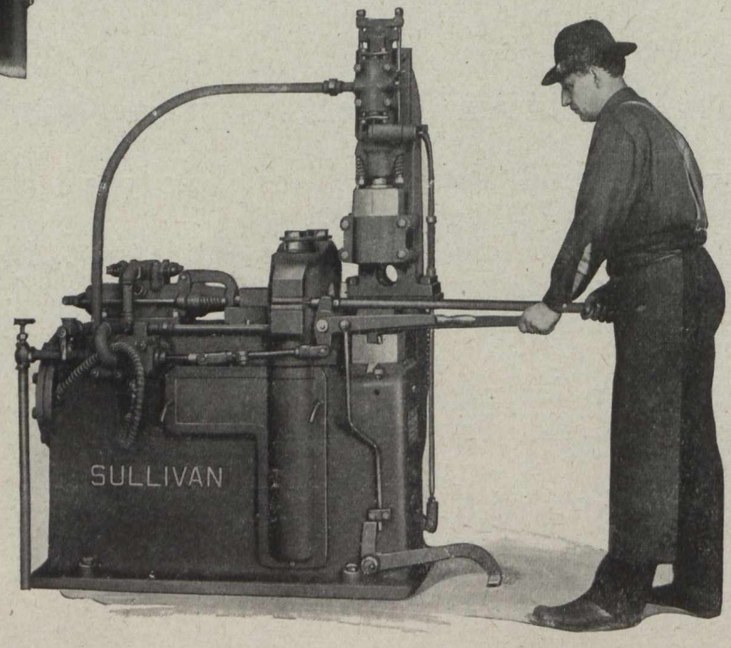

The picture shows how easy it is to remove the pins that are driven into the shanks of Sullivan water-hammer drill steel, to keep the hole open while forging the lugs. The vise is clamped on the pin, then one pull with the forked lever frees the steel. (See upper left corner for finished shank.)

is fussy, slow work, if it must be done by hand, particularly if the steel must be collared or lugged, for use in hammer drills.

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Enormous beds of gypsum of a very pure quality and frequently 100 feet in thickness are situated at the water's edge.

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High-grade cement-making materials have been discovered in favorable situations for shipping.

Fuel is abundant, owing to the presence of 960 square miles of bituminous coal and 7,000,000 acres of woodland.

The available streams of Nova Scotia can supply at least 500,000 H.P., for industrial purposes.

Prospecting and Mining Rights are granted direct from the Crown on very favorable terms.

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HON. E. H. ARMSTRONG,
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PROVINCE OF QUEBEC

Department of Colonization, Mines and Fisheries

The chief minerals of the Province of Quebec are Asbestos, Chromite, Copper, Iron, Gold, Molybdenite, Phospate, Mica, Graphite, Ornamental and Building Stone, Clays, etc.

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.

PROVINCIAL LABORATORY. Special arrangements have been made with POLYTECHNIC SCHOOL of LAVAL UNIVERSITY, 228 ST. DENIS STREET, MONTREAL, for the determination, assays and analysis of minerals at very reduced rates for the benefit of miners and prospectors in the Province of Quebec. The well equipped laboratories of this institution and its trained chemists ensure results of undoubted integrity and reliability.

The Bureau of Mines at Quebec will give all the information desired in connection with the mines and mineral resources of the Province, on application addressed to

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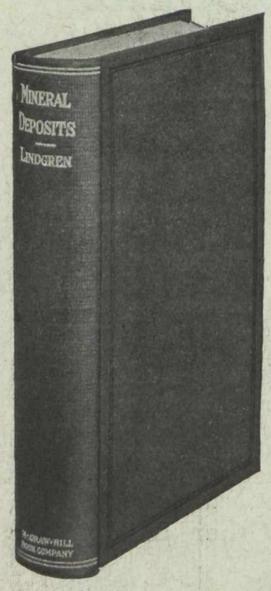
Lindgren—MINERAL DEPOSITS



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Oxidation of Metallic Ores.
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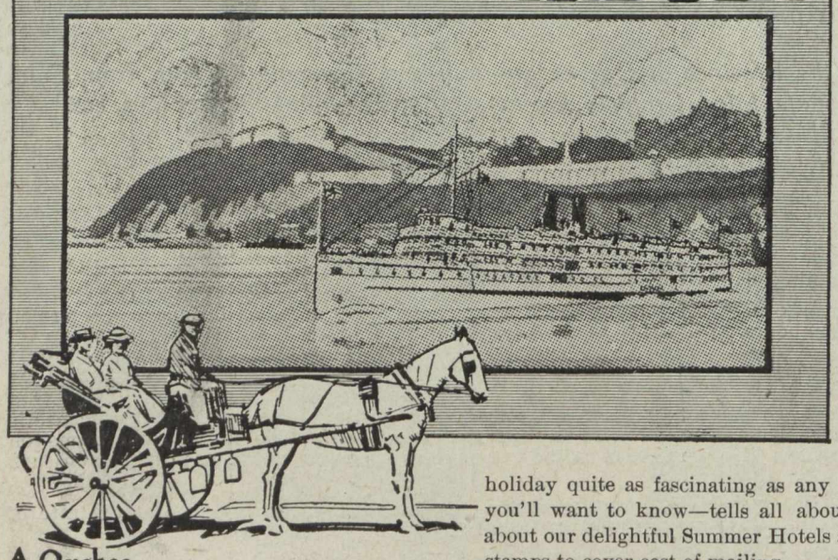

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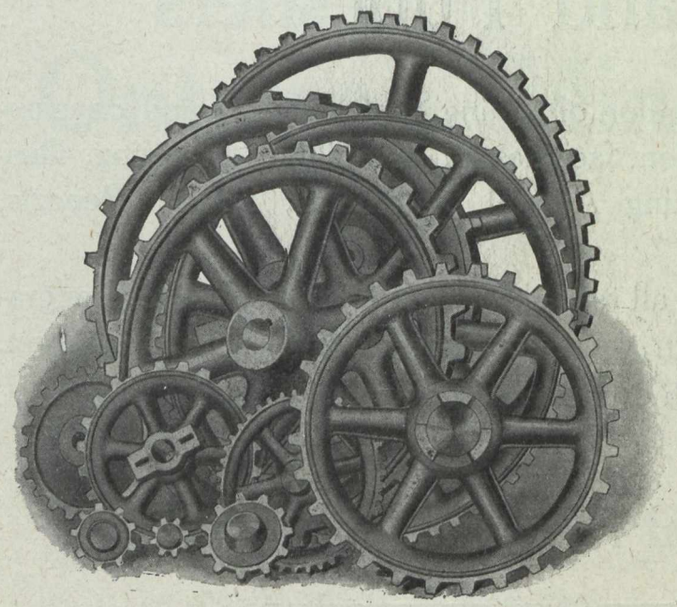

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Synopsis of Coal Mining Regulations

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.

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

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For maps, reports of the Bureau of Mines, and mining laws, apply to

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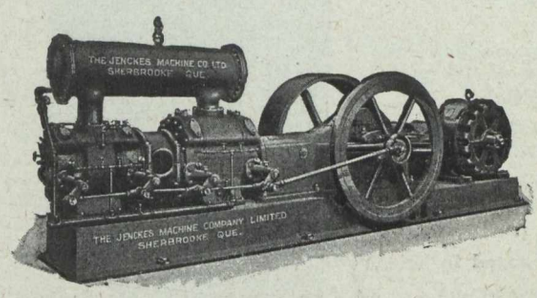

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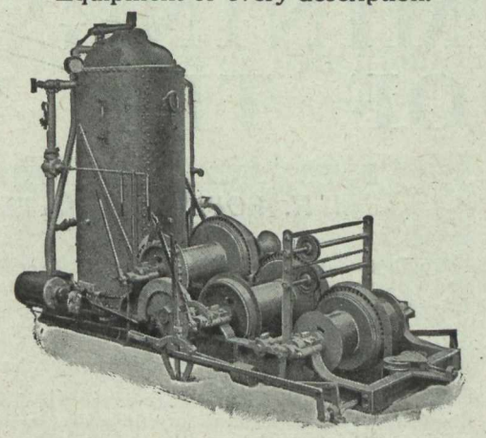

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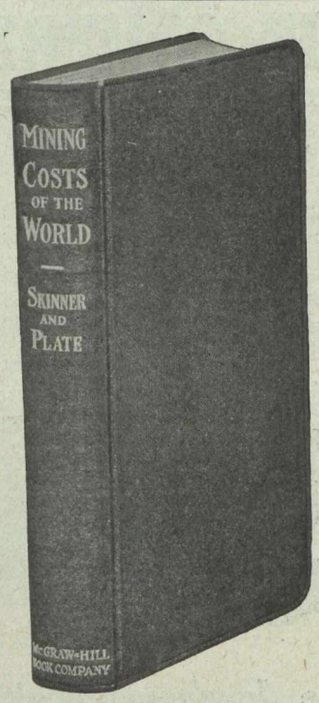

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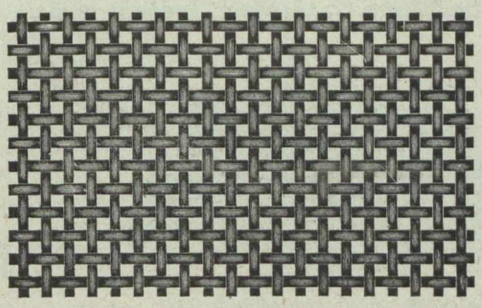

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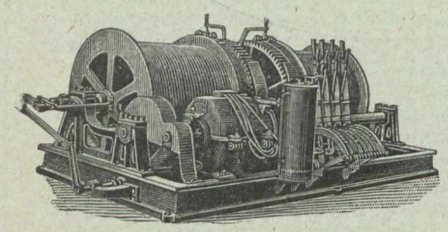

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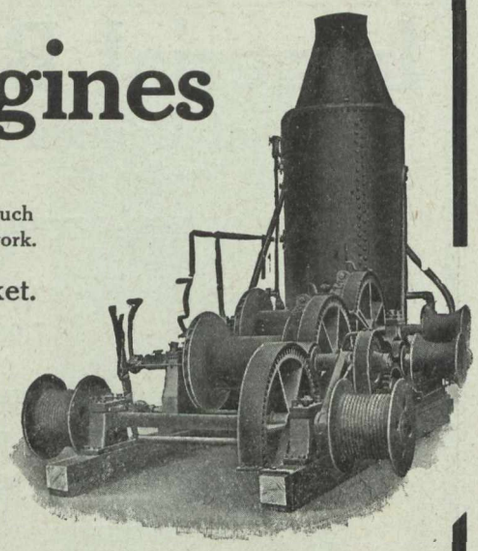

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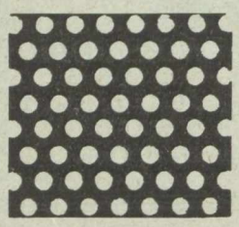

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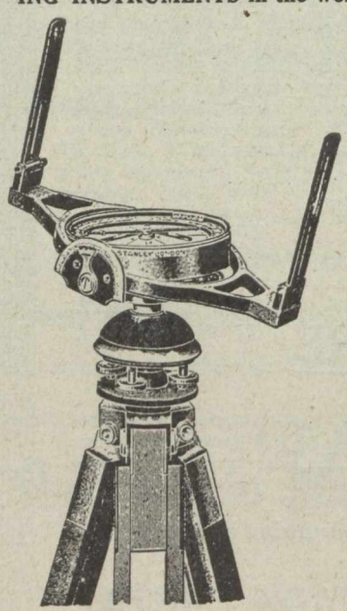

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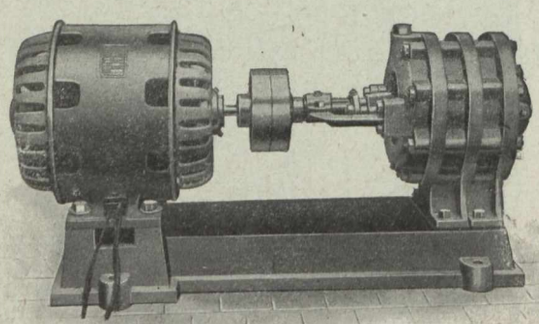

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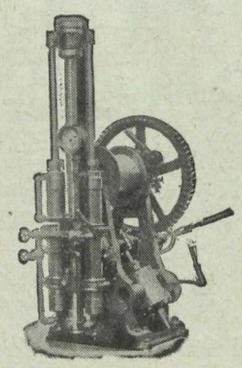

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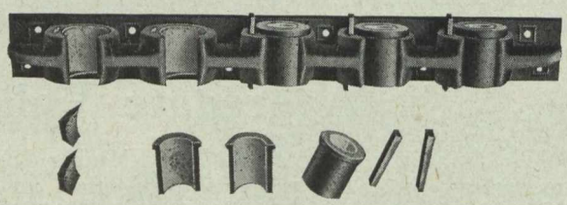

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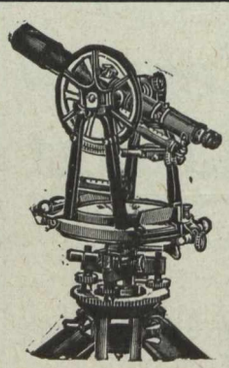

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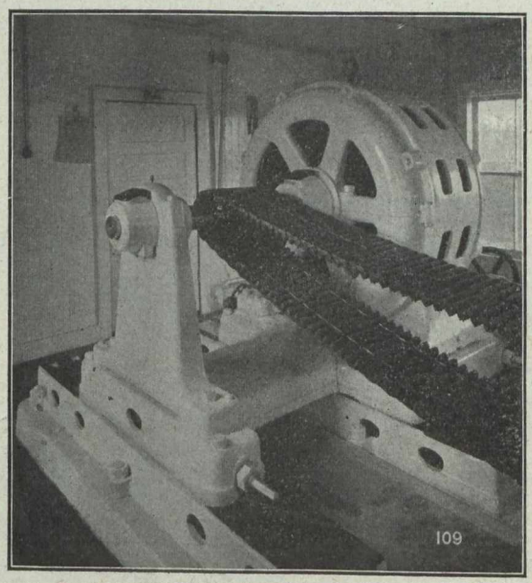

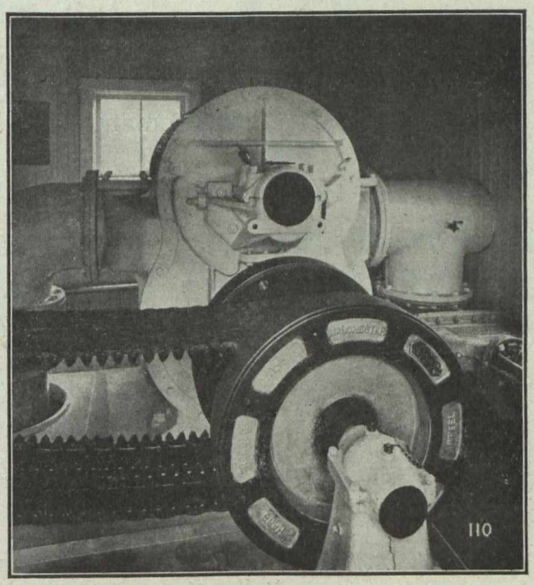

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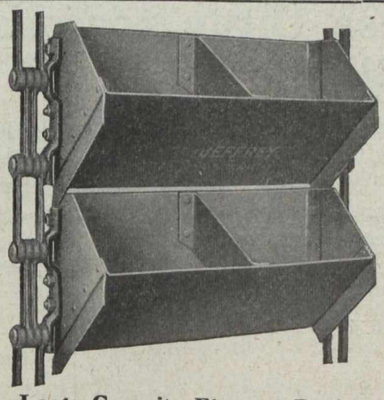

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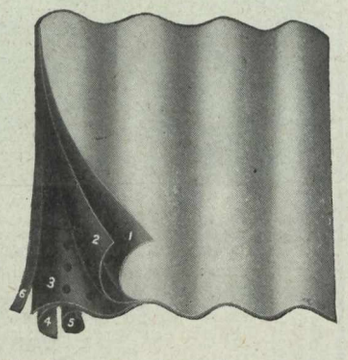

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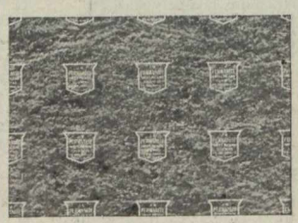

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THE CANADIAN MINING JOURNAL

VOL. XXXVI. TORONTO, Aug. 1, 1915. No. 15

The Canadian Mining Journal

With which is incorporated the

"CANADIAN MINING REVIEW"

Devoted to Mining, Metallurgy and Allied Industries in Canada.

Published fortnightly by the

MINES PUBLISHING CO., LIMITED

Head Office - - - 263-5 Adelaide Street, West, Toronto
Branch Office - - - - - - - 600 Read Bldg., Montreal
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Editor

REGINALD E. HORE

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

CIRCULATION

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

MINERS AND THE WAR

The long threatened trouble in the coal mining districts of South Wales culminated in a strike which lasted only a few days. For weeks the mine owners and employees carried on a warfare which threatened to seriously interfere with the work of the British navy and of the armies in France.

It is said that the miners were dissatisfied because they believed the owners to be making large profits owing to the war. Naturally enough they desire to share in the profits.

It is not surprising that the miners asked for increased pay; but it is almost incredible that they should actually quit work in such a national crisis. Other miners have been playing a noble part in the war. Over two hundred thousand are enlisted and those at the front have proven that the miner is above the average as a soldier. With so many on active service it is necessary that those who remain at the collieries should work steadily. Even at best the output is lower than it should be and some authorities have advocated that miners should be brought back from the front in order that the output be increased. It must therefore have been very disheartening to all who have the interests of the British Empire at heart to learn that the coal miners of Wales had taken advantage of the embarrassing condition of affairs and gone on strike.

As a result of the strike not only was Britain threatened with a shortage of coal but France, robbed of her coal mines by the invading Huns, was placed in the same position. A prolonged strike in the Welsh coal districts at this time could do more damage to the Allies than could a score of German army corps.

Fortunately the disaster has been averted and, inspired by the words of Lloyd George, the miners have not only gone back to work, but they have done so with a better idea of the responsibility which rests upon them. A week has been lost; but the miners have been given an inkling of the danger which confronts the Empire, and we confidently expect soon to learn that they are working as diligently at their places in the mines as are the miners in the trenches in Flanders.

The announcement that the McIntyre Mining Company has purchased a controlling interest in the property of the Pearl Lake Mining Company at Timmins will be well received by those who wish to see the properties developed. Whether shareholders have cause for joy or sorrow depends on the price paid.

Col. Leckie, of the 16th Battalion, is distinguishing himself at the front. He is now reported to be making experiments in England with an apparatus which he has devised to combat the effects of poisonous gas.

THE NICKEL COMMISSION

The Minister of Lands, Forests and Mines of Ontario has announced the appointment of a commission to undertake an investigation of the nickel industry The intention to appoint such a commission was made public some months ago; but there was considerable delay in selecting the chairman, and consequently in announcing the names of the other members.

Obviously the best mining men in Ontario to undertake such an investigation for the Ontario Government are the officials of the Bureau of Mines. The Bureau already has information which it would take an outsider many months to collect, and in Mr. T. W. Gibson and Dr. W. G. Miller the Bureau has two most competent authorities. The Commission will be well posted as to local conditions.

Mr. George T. Holloway, who has been selected chairman of the Commission, is not well known here, but comes highly recommended by British authorities. He has been in practice as a consulting metallurgist and assayer since 1886 and has a fund of technical knowledge which should stand him in good stead in the investigation of the nickel industry.

The naming of Mr. McGregor Young as a member of the Commission indicates that political and legal aspects of the inquiry are expected to assume considerable importance. Mr. Young is professor of constitutional law and international law at the University of Toronto.

It is understood that the B. C. Copper Company will immediately start No. 1 furnace at Greenwood. The smelting plant is operated successfully on very low grade ore and might have been making a good profit during the past few months. It was closed down last fall when the low price of copper made operations unprofitable.

The production of nickel and copper in the Sudbury districts is now far above normal. At the mines and smelters many improvements have been made and efficiency has increased with the production.

Recently elected boards of directors of mining companies controlled by Calumet & Hecla Mining Company show many new names. The boards of subsidiary companies were formerly largely made up of directors of the controlling company. The interlocking directorates are now disappearing.

Mr. H. C. Hoover, who is directing the work of the American Commission for Relief in Belgium, is achieving great things in the German-ridden country. Mining engineers are proud to belong to the same profession as Mr. Hoover.

In a paper to be presented at the San Francisco meeting of the American Institute of Mining Engineers, Mr. Nathaniel Herz, of Lead, S.D., gives a record of observations made while testing a large variety of zinc-dust samples. He concludes that for precipitation of precious metals the zinc-dust should be fine; "most of it should pass through a 200-mesh screen and the fine portion should be very much finer than the screen opening."

The Geological Survey has issued a report by Mr. C. L. Cumming on "The Artesian Wells of Montreal." An interesting feature of the report is the conclusion that the waters can be classified areally, but not according to depth. The author of the report is able to map out areas distinguished by a high content of calcium chloride, calcium sulphate and sodium, respectively.

Copper and spelter are now selling at about the same price—19 to 19½ cents a pound. The demand recently has not been as good as it was a month ago; but many authorities believe that good prices will continue. The chief present concern of owners of copper and zinc mines is how to increase the capacity of their plants, to take advantage of the good market.

The report of Mr. Theo. C. Denis, Superintendent of Mines, of Quebec, on mining operations in Quebec during 1914, has been published. The statistics compiled by the Quebec Mines Branch show that the mineral production of the Province during the year ending December 31st, 1914, reached a total value of $11,732,783. As compared with the previous year, when a value of $13,119,811 was recorded, this is a decrease of $1,387,028, or of 10.57 per cent. Owing to the very abnormal conditions which marked the whole second half of the year 1914, it is a matter of gratification that the figures have not shown a greater falling off. As it is, the total mineral production is greater than that recorded for 1912, when it was $11,187,110. The revised figures of the mineral production of the Province of Quebec during the year 1914, were preceded by a preliminary statistical statement, which was issued on February 23rd, 1915, and appeared in the "Journal" March 1. These preliminary statistics, which were published subject to revision, gave a close approximation, at an early date, of the production of the various mineral substances during the year. In fact, the total given in this early statement only differed by $407,355, or 3.47 per cent., from the finally revised figures.

DOME MINES.

The following statement, which lacks official confirmation, has appeared in several Eastern papers:

Recent development work of Dome Mines Co. has added 375,000 tons of high grade ore to the company's ore reserves. Estimated value of this ore is $5,625,000 on conservative basis of $15 a ton, although much of it runs $19 and $21.43 a ton. At the close of the last fiscal year on March 31, the company's ore reserves were valued at $11,576,857, so that additional ore blocked out in barely more than three months since, brings value of ore reserves to $17,201,859. Further development work is expected to add greatly to reserves of high grade ore.

THE PROSPECTOR'S DIFFICULTIES

To the Editor of the Canadian Mining Journal:

Sir,—In your last issue you, like the Mail and Empire of July 10th, advise prospectors to get into the bush. That may appear an easy matter; but in the same issue you give one of the main reasons for staying out, namely, the state of the roads. If it takes seven hours to get from Gowganda to Elk Lake, how long will it take to go from Ruell to Gowganda?

It has been stated that the Government was going to do something to assist the prospector; but it does not look like that to some of us. Moreover, it's not only prospectors who should go into the bush, but Government representatives who can state facts in reasonable time, instead of taking 18 months or two years to give out information.

About two years since the Government did start to cut a road to West Shiningtree lake, just under 20 miles. About twelve miles was graded. Last May twelvemonth I tried that road by wagon from mile 85. The first twelve miles was fairly good. Then came the bumps. I drove on until I could stand it no longer. Then I started to walk, while three cases of eggs ran out of the wagon. At seventeen miles the wagon could be drawn no further. So after paying for the trip I had to carry the load myself the last three miles. This three miles was a terror, and on arrival at the Lake I was wet up to the armpit, having gone into holes that deep through snow slush.

I learn that the road is not improved to-day. Why? Surely not because the Government does not get the money, for almost four townships have been staked and recorded there, and every prospector pays $5 license fee, with $10 for permit, and then does assessment work on each claim. Together with recording fee $10, traveling expenses, etc., would bring cost of each claim to easily $650. How can prospectors stand that long? Well, there are not many left now. I could say a lot more, but I think it would go into the waste-basket.

It is not more or better prospecting that is required; but capital to develop what has been discovered. Then the prospector would take heart.

Yours, etc.,

Chapleau, Ont., July 21. ROBERT HOLDING.

The Editor of the Canadian Mining Journal:

Sir,—In closing my letter yesterday I neglected one or two items which I had intended to mention.

Regarding cost to prospectors: I don't see the justice of the $10 fee—renewable annually—in special mining divisions as at present called for in Ontario.

Regarding the estimate of $650: To this must be added survey. This is no small item; but varies according to distances and chances of others taking advantage of the presence of the surveyor. Then to this must be added $1 per acre the first year after issue of lease.

I hold that there are few prospectors who can honestly conduct operations in accordance with the Mines Act without some outside assistance, which is generally from a man who has little or no knowledge of the subject and who soon tires of finding money. The result is delay, and probably loss. Now we come to consideration of an attempted sale. Things are different to-day to what they were during Porcupine days, and even now it would appear Porcupine should allure capital. Even at Porcupine many good prospects do not get recognition. It is therefore disheartening to men who have speculated their savings, roughed it winter and summer when they are required to prove by every means what they have by stripping, sinking, etc., before their claims will be even looked at.

Regarding roads, why not utilize the alien labor now so plentiful and costly to the people, instead of allowing these alien enemies to go to the mad house owing to want of occupation?

Yours, etc.,

Chapleau, Ont., July 22. ROBT. HOLDING.

On January 1 the Journal published a communication relative to the mineral production of British Columbia in 1914, received from its regular correspondent in that Province, who, about the middle of December, wrote as follows:

"As the year draws to its close it is possible to make a rough estimate of the value of the mineral production of British Columbia during 1914. With only very incomplete information as a guide, it seems probable that a total value of between $25,000,000 and $26,000,000 may be estimated. It may be the latter amount will be slightly exceeded, but at this writing it seems better to place the total at somewhere about $25,900,000. Of this amount, approximate proportions are: Metalliferous minerals $15,100,000, coal and coke $7,800,000, and miscellaneous products $3,000,000." As the official revised figures are now published, a comparison may be made; they show the following sub-totals: Metalliferour minerals $15,790,061, coal and coke $7,745,847 and miscellaneous products $2,852,917; total $26,388,825. The net difference between the total as estimated early in December by our correspondent and that arrived at by the Provincial Department of Mines after all official and other returns had been received was $488,825, the estimate published by the Journal six months ago having been that amount less that the official total made public last month.

Among the publications issued recently by the United States Geological Survey is Professional Paper No. 87, Geology and Ore Deposits of Copper Mountain and Kasaan Peninsula, Alaska, by C. W. Wright, 1915. This is described in an official list of new publications as follows: A detailed description of the geology of Kasaan peninsula and Copper mountain, the two most important copper-bearing areas in southeastern Alaska, prefaced by a general account of the geology of the Ketchikan district, within which these areas lie. The mining development is only briefly discussed, because it is not of permanent interest and is fully treated in the Survey's annual bulletins showing the progress of investigations of mineral resources in Alaska. The genesis and occurrence of the copper ores are discussed, and special attention is paid to contact deposits, which are well exemplified in this region. The illustrations include a geologic map of the Ketchikan district, topographic and geologic maps of Copper mountain and Kasaan peninsula, plans and sections of mines, and half-tone views of rocks and minerals from the areas discussed. The Granby Consolidated Co. is operating several mines on Kasaan peninsula.

During the first quarter of the current fiscal year, ended June 30, there were received at the Dominion Assay Office, Vancouver, B.C., 387 deposits of gold bullion, as compared with 271 for the corresponding quarter of 1914. The number received in June, 1915, namely, 165, was much larger than that in June, 1914.

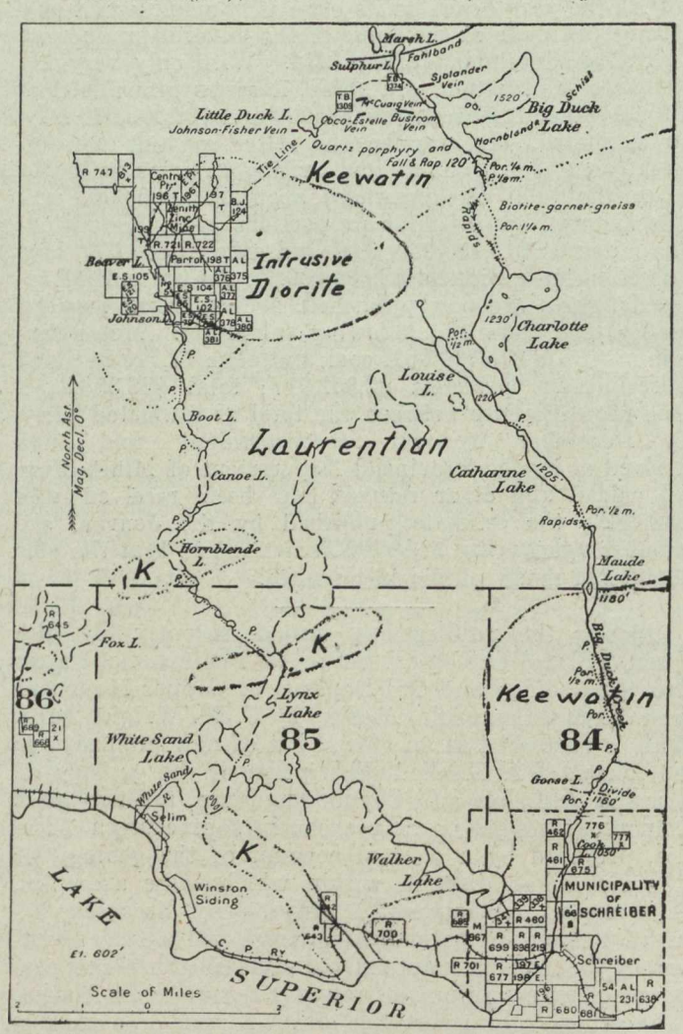
SCHREIBER OR BIG DUCK LAKE GOLD AREA.

According to memorandum issued by Dr. W. G. Miller, of the Bureau of Mines, to accompany a map of the Schreiber area by P. E. Hopkins, not much has been done as yet to develop this area. The following information may be of some use to anyone desiring it. Mr. McCuaig, of Schreiber, and the gentlemen whose addresses are given as Nipigon, will be able to furnish further information. Canoes and guides can be obtained, it is said, at Schreiber.

J. Bustrom, Nipigon, is owner of T.B. 2071; Dave McCuaig, Schreiber, is owner of T.B. 1686; Carl

GEOLOGY AND CANOE ROUTES
FROM
Schreiber to Big Duck Lake

To accompany Report by P. E. Hopkins, in Part I, Vol. 24, Report of Ontario Bureau of Mines, 1915
Hon. G. H. Ferguson, *Minister.* Willet G. Miller, *Provincial Geologist.*



Sjolander, Nipigon, and Mr. McKirdy, merchant, Nipigon, are owners of T.B. 1861 and 1955. These owners may not have full control of the claims, but this is the information at hand.

The J. Johnson claim, south of Little Duck lake, gave from a sample across 5 ft., $7.60. It apparently did not show any visible gold. The Coco-Estelle claim, T.B. 2093, gave from a sample across 4 ft. of quartz and pyrites, $8.60. The McCuaig claim, T.B. 1686, is said to contain rich gold ore, so rich that some of it has been hand-picked and shipped during the last winter. The Sjolander-McKirdy claims are said to have a large vein which has a pay streak near the hanging wall. The Bustrom claim is said to have a large vein, the samples from which gave 2 per cent. copper and 20 cents gold.

BEAVER.

Under date of July 14, 1915, President F. L. Culver sent out the following letter:

To the Shareholders of Beaver Consolidated Mines, Limited:

The first quarter of the company's year (1915-16) terminated on the 31st of May. About May 1st, the contract for power which existed between Beaven Consolidated Mines, Ltd., and the Northern Ontario Light and Power Company expired. Since that time matters have been in a very unsettled condition between the two companies and we did not wish to send out our report until we were in a position to give the shareholders some information in regard to this subject. The new contract submitted by the Power Company contained terms and conditions which your directors did not deem advisable to accept, and it looked for a time as though it would be necessary to join with the Temiskaming Mining Company, our neighbors who were experiencing similar difficulties, in the erection of a plant of sufficient capacity to supply both companies with power. This would involve the expenditure of a large amount of money. However, after several conferences with the Power Company, arrangements have been made so that we will continue operations temporarily under practically the old conditions.

The development work for the quarter is as follows: Drifting, 1,039 ft.; crosscutting, 204 ft.; raising, 75 ft.; total, 1,318 ft.; stoping, 1,440 cu. yds.

The main shaft is down to a depth of 1,000 ft., and it is our intention to continue sinking until we go through the diabase sill and reach the lower contact. As we have previously advised you, our operations are at a minimum owing to the low price of silver, consequently development work has not been as large as in previous quarters. We are disposing of just sufficient silver from time to time to pay our operating expenses, carrying a large amount of silver bullion in storage in New York.

We have found it necessary to increase the capacity of the concentrating mill to 150 tons a day. This new installation will be completed in about six weeks.

May 31st.	Ozs.
Bullion in storage in New York..	259,480.10
Ore in transit and at smelters ...	65,899.97
Ore bagged at mine	41,221.40
Total.	366,601.47
Cash on hand	$79,846.95

Mr. Frederick G. Cottrell, of San Francisco, California, chief physical chemist for the U. S. Bureau of Mines; Mr. D. A. Lyon, of Salt Lake City, also an official of the Bureau, but who is in charge of the Department of Metallurgical Research at the Utah University, and Mr. W. H. Howard, of Salt Lake City, general superintendent of the American Smelting and Refining Co.'s Utah division, and practically at the head of its research department in that part of the United States, visited the Consolidated Mining and Smelting Co.'s smelting works at Trail, B.C., on July 18, going thence via Nelson to the Coeur d'Alene district of Idaho. Their purpose in going to Trail is stated to have been to ascertain what progress had been made there in connection with experiments in the reduction of lead-zinc ores.

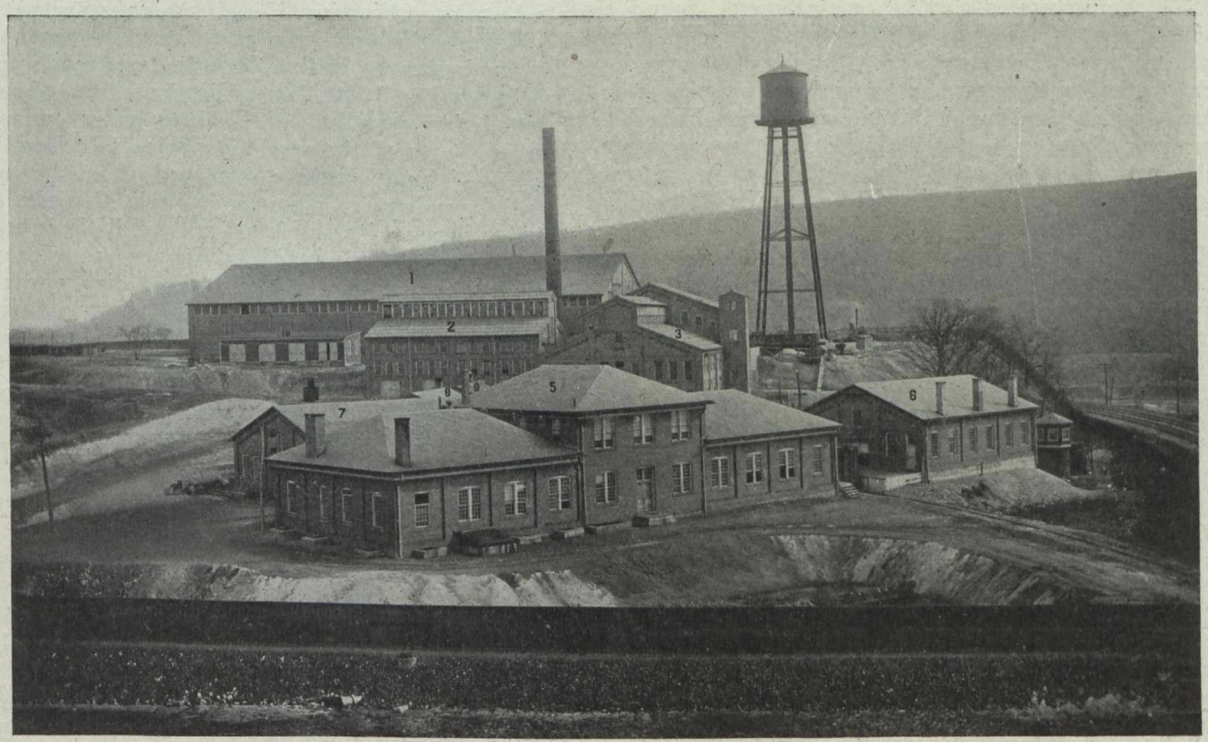
VANADIUM: ITS CHEMICAL AND METALLURGICAL TECHNOLOGY

By F. M. Turner, Jr.

On account of its ever increasing use in the making of special steels for automobiles and railroad purposes vanadium alloys are now produced in such large quantities and the ores of the metal mined and sought for to such a degree that it can no longer be spoken of as a "rare element" as was the case even ten years ago. Hardly more than ten years ago vanadium compounds were known only to the dealer in chemicals who handled a few costly salts of the metal, for which there was a limited industrial application. When ferro-vanadium first began to be manufactured, after it was found that its addition improved the quality of steel, the limited sources of vanadium ores were soon exhausted, and the price asked for the alloy was so high as to make steels containing it of little more than academic interest. Moreover, the impurities contained in the early ferro-vanadiums were so great that the results obtained on its addition were often far different from what was expected and it took some little time for the use of the element to rise into favor. To-day all has changed. A large American company has, after the expenditure of vast amounts of capital, rendered accessible enormous supplies of vanadium ore of high-grade quality in South America. By the maintenance of large and well-equipped research laboratories they have improved the methods of production so as to guarantee a uniform product to the user and have so standardized and improved their process as to make the price but a small fraction of what it was necessary to charge some years ago. Academic and industrial investigators in America, England, France and Germany have studied the properties of the alloys of the metal with iron, carbon, manganese and other metals and to-day the user of ferro-vanadium does not have to rely altogether on empirical rules, but can know largely in advance the exact effect of the addition of the element to steel, and the most efficient manner to accomplish the desired result.

Historical sketch.—To a Mexican, Del Rio, belongs almost, but not quite, the honor of the discovery of this most useful element. Del Rio actually discovered it, but he was led by circumstances to renounce his own discovery.

For the following facts about Del Rio, the writer is indebted to an article in the Bulletin of the Pan American Union written by Mr. Wells of their staff, who by careful research in the archives of Mexico and Spain found the details of Del Rio's career and his great discovery. Andres Manuel Del Rio, Professor of Mineralogy in the Royal School of Mines of the City of Mexico, was born in Madrid in 1764 and graduated from the University of Alcala de Henares in 1780. He was pensioned by the Spanish government and sent to study in England, France and Germany. There he spent about twelve years, studying mineralogy and mining, and worked with many great scientists—among others, Lavoisier. When he returned to Spain he was made one of a group of savants who were sent to Mexico to establish the Royal School of Mines in Mexico, and given the position of Professor of Chemistry. He later asked that the title be changed to Professor of Mineralogy. The school opened in 1795. Del Roi became interested in politics and was one of the advocates of Mexican independence. After the expulsion of the Spaniards from



AMERICAN VANADIUM COMPANY'S NEW PLANT

Mexico he lived for a time in the United States, but returned to Mexico and died there in 1849.

A district in the State of Chihuahua, where so many great mines are located, is named after this pioneer of learning in Mexico. In 1801 when examining some lead ores from the mines at Zimapan in the State of Hidalgo, Del Rio thought he detected a new element, and he called it erythronium, from a Greek word for red, since its salts with certain chemicals gave a bright red color. He thought it was allied to chromium, and had he left well enough alone erythronium would be its name today and Del Rio alone would be hailed as its discoverer. Unfortunately Del Rio bowed to authority and when Collet Descotils, the great French analyst, published an article calling Del Rio's erythronium merely impure chromium, Del Rio accepted his decision and in the Annales de Ciencias Naturales, Madrid, 1804, disavowed his former claim and stated the substance to be a lead chromate. So the matter rested till 1830, and we might very appropriately call the vanadium "the element that got lost" for during this long period nothing was heard of it at all.

In 1830 Sefstroem, a Swedish metallurgist, found a new constituent in the slags of the famous Swedish iron of Tabberg. Not knowing of Del Rio's discovery he thought he had a new element, and he named it after a Norse divinity, calling it vanadium, from Vanadis, the surname of the goddess "Freya." In the same year Woehler proved the identity of vanadium and erythronium, and the next year the great chemist Berzelius made an exhaustive study of the element and its compounds. Although full of mis-statements which have since been corrected, and which were inseparable from the work on account of the newness of the subject, this treatise of Berzelius's remained the source of most of the information about this element till 1867 when Sir H. E. Roscoe made a thorough and accurate study of the chemistry of vanadium, Roscoe's pioneer work has been the starting point of most of the subsequent researches on the subject.

The chief error made by Berzelius was the mistaking of the lowest oxide of the element for the element itself, which threw out all his other formulae. This also led to his classing the element with chromium and molybdenum, in which opinion Woehler concurred. On account of the prestige of these two great names it was so regarded without a doubt till Schabus and Rammelsberg showed the perfect analogy between vanadinite, apatite and pyromorphite, and, mineralogical ideas carrying great weight just at that time in chemistry, this disturbing factor opened the minds of the chemical world to a change, and as a result of Roscoe's work it was placed where it is now known to properly belong, in the fifth group of Mendeleeff's Table, along with niobium and tantalum, forming a sub-group closely related to nitrogen, phosphorus, arsenic, etc. At present the analogies between vanadium and phosphorus and arsenic are more striking than those between vanadium and the other elements of its own group, but when the compounds of niobium and tantalum are further investigated this will be cleared up. The salts of the per-acids of vanadium, niobium and tantalum, which have recently been investigated by Melikoff and Pissarjewsky in Russia, are, however, quite analogous, and no doubt many other similarities will be found.

Early uses.—Early in the sixties vanadium began to play a certain role in industry and it was discovered that it was a remarkably efficient agent for the formation of aniline-black from aniline. At this time all the world's vanadium was obtained from the slags of the Creusot steel works in France. Later as slightly more was used it was extracted from lead vanadates mined in Spain by a process due to Herrenschmidt. In this process the ore was roasted with soda and charcoal, giving lead which carried a good deal of silver and a slag from which vanadium was worked up in the form of a solution of sodium vanadate. From this ammonium vanadate was precipitated and this was roasted and the oxide prepared and sold. Later iron and nickel vanadates were precipitated from the solution and these reduced aluminothermically, but in no case was the price of vanadium much reduced. The process was not at all efficient, 2 per cent. of the vanadium being left in the slag and arsenic, which was objectionable, being carried into the finished product. Inventions were made to get around both these difficulties, but soon after this more easily worked ores and better processes were invented and no commercial vanadium is now prepared in this way.

About 1910 the usefulness of vanadium in steel was demonstrated beyond a doubt by French investigators. Choubley in 1896 seems to have been the first to make this important discovery. Choubley was director of the steel works at Firminy. Neither his researches nor those of Helouis the next year were very successful and the first real advance in this direction was made by Arnold in England in 1900. Immediately a large demand was created for vanadium and mines being opened up in various parts of the world its price fell from the very high one it had formerly remained at, to that of a commercial product. Curiously enough, German chemists, usually so much to the front, played little or no part in the development of vanadium, France, America and England leading in the order named. Moissan was the first to prepare pure vanadium in the electric furnace and Gin made a fairly good grade of ferro-vanadium by the aluminothermic method. The process for the treatment of the ore and the production of vanadium products on a large scale has been worked out in America, but to the French and English we owe most of our exact knowledge of the structure and metallography of the steels to which vanadium is added, Guillet in France and Arnold in England being the chief workers on the subject.

Occurrence of Vanadium.—Vanadium is a singularly widely distributed element, but in most places where it is found it is in quantities so small as to be of no practical importance. It occurs in the sun, in almost all rocks both igneous and stratified, in sea-water, in coal, in petroleum and in plants. Many commercial products such as alkalies, acids and pig-iron contain some vanadium.

A large number of vanadium minerals of well-defined composition and form are known, but only a few are of either academic or commercial importance. Vanadinite is described in all text-books as the chief vanadium mineral, and until a few years ago it was so. It is isomorphous with pyromorphite and apatite and has the composition $(PbO)_3.V_2O_5.PbCl_2$. It is found in many parts of the world. It is generally of an orange or red color and occurs in hexagonal prisms. When the lead is partly replaced by zinc the mineral is known as dechenite areoxene or eusynchite according to the extent of the substitution. When there is no chlorine present it is known as descloizite, which crystalizes in the orthorhombic system, and can be considered a lead pyrovanadate Cuprodescoizite, brackebuschite, ramirite, tritochorite and psittacinite are all varieties of this mineral containing various admixtures of copper and zinc. The volborthites and calcovolborthites are copper vanadates discovered in Europe. Pucherite is a vanadate of

bismuth found in Saxony. Calcium vanadate, called vanadiolith, has been found, and also free vanadic acid has been discovered on the shores of Lake Superior in small quantities. Good specimens of nearly all these minerals, and of many varieties of some of them may be seen in the National Museum at Washington, D.C., and some of them, especially the vanadinites, are very beautiful.

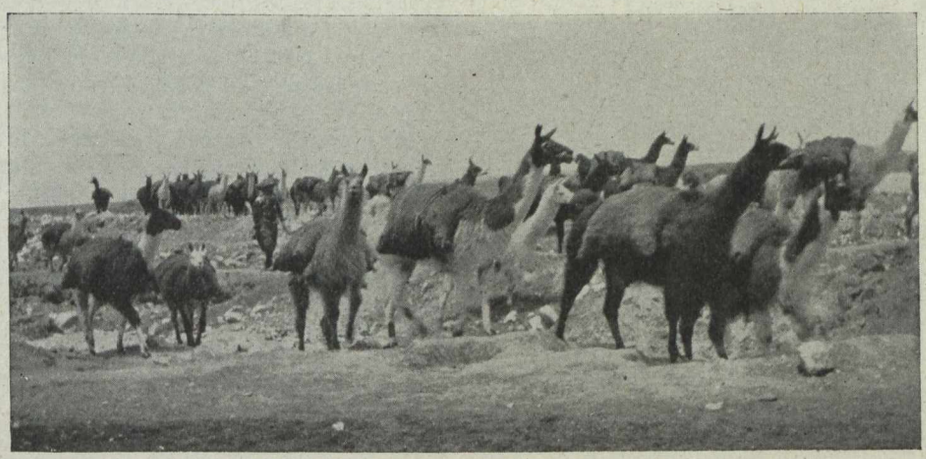
Roscoelite is a vanadium mica which has been mined for many years in the western part of the United States and contains about 25 per cent. V_2O_3. As one might suppose from its being a mica, it presents great difficulties in treatment, and vanadium products prepared from roscoelite find it hard to compete with those from more readily worked ores.

Carnotite is now a well-known mineral. It occurs on sandstone and other substances as a yellow incrustation or impregnation. It is a potassium-uranyl vanadate and possess the formula: $K_2O2UO_3V_2O_5 3\ H_2O$. It has been largely mined in Colorado and Utah as a source of radium, and most of the world's radium to-day is made by a Pittsburgh corporation from the uranium content of this ore. It has not yet been found practical to use it as an ore of vanadium, even with the radium as a valuable by-product, but research work is being done continually on this proposition by the corporation alluded to, which controls immense holdings of carnotite

establishment in the world, as it is very near the summit of the Andes. The increase in vanadium-content made by this simple operation is readily seen by an inspection of the two following analyses made by Kent-Smith.

Before Roasting—	Per. Cent.
VS_3	39.84
MoS_2	1.57
FeS	4.07
NiS	1.49
S	30.57
SiO_2	13.60
Al_2O_3	2.46
Alkalies, rare earths, lime	1.40
Moisture	5.00
After Roasting—	**Per Cent.**
V_2O_5	58.08
MoO_3	2.62
Fe_2O_3	4.98
NiO	2.24
S	0.23
SiO_2	25.00
Al_2O_3	4.52
Alkalies, rare earths, lime	2.56

By this operation the vanadium content is raised from less than 14 per cent. to rather more than 30 per cent. In the same deposits with the patronite appear other



VANADIUM ORE TRAIN, PERU

deposits. The United States Bureau of Mines is also making radium from carnotite and selling the vanadium residues to a steel concern which works them up into vanadium alloys.

Immense amounts of impregnated sandstones, with small, but uniform, content of vanadium go under the name of vanadiferous sandstone, and await a metallurgical process sufficiently efficient to extract their small vanadium content.

The most important and the most curious ore of vanadium is patronite, an impure sulphide of vanadium containing much free sulphur, which occurs in asphaltite deposits in the Peruvian Andes. These deposits were discovered in 1905 by Patron, after whom the ore is named. These mines have been developed and are owned by the American Vanadium Company, of Pittsburgh, who ship the ore from Callao to their plant at Bridgeville near Pittsburgh, where it is made into ferro-vanadium. Over 75 per cent. of the world's production is made by this company, from this source. The patronite is not shipped as mined, but is roasted at a plant at the mines, probably the most lofty industrial

minerals which seem to be oxidation products of patronite, but are not mined. The genesis of these deposits is a complete mystery, but it seems to be in some way connected with the highly vanadiferous lignites of Mendoza and other places and the vanadiferous asphaltites of Yauli.

Physical and chemical properties of vanadium.—Pure metallic vanadium was prepared for the first time in 1904 on a very small scale, and consequently the many published statements regarding the physical properties of the element prior to this date are of small value. Roscoe tried to obtain it by reducing VCl_2 with hydrogen, and obtained a silvery metallic powder, which, however, contained some hydrogen. Moissan's vanadium obtained in the electric furnace contained considerable carbon. It was whitish and exhibited a metallic fracture. Weiss and Aichel reduced oxides of vanadium with Mischmetall and obtained a white regulus which showed facets of hexagonal-rhombohedric crystals, which agreed well with the element's position in Mendeleeff's Table along with arsenic, antimony and bismuth, which also take this habit.

According to the most reliable data pure metallic vanadium is a hard white lustrous metal. It is the hardest of metals, its hardness being above 7 on the mineralogists's scale. It is not scratched by quartz or steel. It is not magnetic. The density of perfectly pure vanadium is not known, but Moissan's vanadium containing about 5 per cent. carbon possessed a specific gravity of 5.8, and the hydrogen-containing material of Roscoe a specific gravity of 5.5. According to Mache its specific heat between zero and one hundred degrees is 0.1153. Smith reported its melting point to be above 2000°C., and Moissan said that although it would melt in his electric furnace it took a higher heat than any other metal, but it is now known pretty definitely from the work of Werner von Volton and others that the melting point is not so high, about 1680° being near the right temperature. His data were obtained from photometric measurements of great accuracy. Its atomic weight is 51 in round numbers.

The most noteworthy general chemical property of the metal is the great number of compounds to which it gives rise and the extraordinary readiness with which it combines with most elements. When not heated it does not oxidize readily in the air, and preserves a bright lustre for weeks at a time, but very little heat will cause it to take on a coating of vanadium pentoxide, V_2O_5. According to Chilesotti, hydrochloric, hydrobromic and cold sulphuric acids and potassium hydroxide have no effect on the metal. Hot sulphuric acid and hot solutions of potassium hydroxide attack it readily, and it dissolves rapidly in nitric acid and aqua regia forming green solutions. It alloys readily with iron, nickel, cobalt, copper, aluminum, tin, platinum and other metals. It also forms binary compounds with silicon, phosphorus, nitrogen and carbon, and possibly with hydrogen. Colloidal vanadium has been obtained by Svedberg by his usual method, using some of the higher alcohols (e.g. isobutyl) as the solvent, and these solutions, which are dark brown in color, are stable for several weeks.

Vanadium forms five well defined oxides. These are the pentoxide, V_2O_5, often alluded to as vanadic acid, the tetroxide V_2O_4, the trioxide V_2O_3, and the lower oxides VO and V_2O. Each of these except the last forms series of salts with acids, and two of them form acids which give rise to vanadates and vanadites and a host of more complex compounds. When vanadium can find nothing else to combine with it combines with itself, and vanadates of the radical (VO) called vanadyl are well known. The nomenclature of these various oxides and their compounds is very unsettled, and the best that can be done is to refer the reader to Gmelin-Kraut, Bd. III. Ab. 2, page 73 et seq., where the whole matter is discussed at length. Other intermediate oxides have been reported, but they probably are mixtures of those listed above.

The interesting thing about these oxides is the ease with which one is converted into the other, especially in the case of the tetroxide and pentoxide. Vanadium pentoxide is reduced to tetroxide and again takes up oxygen from any oxidizing agents present with such rapidity, that this catalytic power has been much studied and some practical applications made of it. The most satisfactory black dye for fabrics is aniline black, and this black is made by the oxidation of aniline hydrochloride with various oxidizing agents, potassium chloride being the commonest. In order to make the reaction proceed with sufficient velocity for commercial purposes copper salts were added. Lightfoot, an English dye works chemist, tried salts of various elements and found that many of them possessed the property of accelerating this reaction, and that copper was superior to all the elements except vanadium, but when they tried vanadium they found almost infinitesimal traces of this element would turn immense quantities of aniline solution into aniline black. Since that time this catalytic property of the salts of vanadium has been the subject of much study and it is quite unique. In addition to its application in dyeing it has been used in medicine and no doubt will find many other applications.

The only one of the compounds of vanadium which requires detailed description in such an article as this is the pentoxide. It exists in several modifications, a crystalline one which is almost insoluble in water, and two amorphous modifications, one of which dissolves in water, but with difficulty, and the other readily. This last solution is now thought not to be a true solution, but a colloidal one. This acid dissolves in concentrated sulphuric acid giving deep red solutions. When these solutions are diluted with water they turn green, owing to a partial reduction of the vanadium pentoxide to tetroxide. With concentrated HCl it forms green solutions and gives off chlorine, according to the equation:

$$V_2O_5 + 2HCl = H_2O + Cl_2 + V_2O_4.$$

In alkalies it dissolves and forms alkaline vanadates of which potassium vanadate, KVO_3 is a type. Ammonium vanadate is insoluble and ammonium metavanadate NH_4VO_3 is the commonest commercial salt of vanadium, and from it vanadium pentoxide is prepared by calcination.

Although a great deal of work has been done on the compounds of vanadium there still remain innumerable points to be cleared up, many of which would lead to remarkable improvements in the methods of extracting the metal from its ores, for the metallurgist who essays to invent a hydrometallurgical treatment for any of the vanadium ores to be found in America is continually hampered by the inadequate data regarding the reactions of the element. Up to the present only a few chemists have been in a position to obtain vanadium salts in large enough quantities to work with the element, but now that these salts can be got comparatively cheaply and of great purity, it is to be hoped some of the mysteries surrounding the chemistry of the element will be cleared up. There has also been a tendency to attribute an inherent waywardness to the reactions of this element. The author has often heard the remark made, "Well, if it wasn't vanadium we might expect such and such things, but no one knows what vanadium will do—it never does the same thing twice." Now, we all know that such talk, even if in fun, is wrong, for vanadium no less than any other element is amenable to ordinary laws of chemistry. Under the same conditions it will give the same reactions at all times and in all places. Only these reactions may be so complex that changes in conditions which would not interfere with the reactions of other more easily handled elements will here be of great importance, and this fact must be heeded. In the next section of this article we will deal with the metallurgical properties of vanadium, and with vanadium-steels. A reference list of a few of the more important contributions to the literature of the subject is appended.

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TEMISKAMING.

President F. L. Culver sent out the following letter on July 19 to the shareholders of the Temiskaming Mining Co., Ltd.:

The following is a record of the development for six months ending June 30, 1915: Drifting, 1,740 ft.; crosscutting, 657 ft.; raising, 323 ft.; winzes, 85 ft.; total 2,805 ft.; stoping, 3,562 cu. yd.

In the old vein system, on the 350 ft. level, No. 3 vein, we have developed a large block of mill rock. Between the 400 and 500 ft. levels, vein No. 15 is from 1½ to 3 in. wide carrying high grade ore in places, and vein No. 2, south stope, is 3½ to 6 in. wide of good mill rock, with splashes of ruby silver and some smaltite. In the winze which was started from the 750 ft. level, sinking has been continued to a depth of 85 ft., 50 ft. of which carried ore. Drifting back under the shaft and raising, making a connection, will give the shaft a total depth of 835 ft. from the surface.

In the new vein system, on the 400 ft. level in drift No. 21, we have a vein 5 in. wide of 3,500 oz. ore. We have drifted on this toward the Beaver property 135 ft. and are now within 20 ft. of the Beaver line. Timbering is being done preparatory to stoping this ore when necessary. Ninety feet west of drift No. 21, we have encountered a calcite vein about 5 in. wide, but as yet no development work has been done on same. On the 500 ft. level, drift 21 is practically up to the Beaver line. The north breast stope shows five veins of rich ore each from 1½ to 2 in. in width and the country rock between these veins carries good milling values. The breast of the cutting out stope, No. 23 drift, is now 190 ft. south of the Beaver line and the vein carries high grade for this distance.

In order to carry out our policy of deep mining, it was found necessary to install a new hoist. This is being built by the Nordberg Manufacturing Company of Milwaukee and we expect to have it installed and running within sixty days. This hoist will enable us to reach the lower contact between the diabase and the Keewatin formations (a depth of between 1,600 and 1,700 ft.), and it is believed that as rich values will be encountered at the lower contact as have been developed at the contact above. This work will be pushed forward as rapidly as conditions will permit.

The contract which existed with the Northern Ontario Light and Power Company expired some little time ago and a new contract was submitted, the terms and conditions of which were not satisfactory, consequently we refused to sign the same. Quite a little discussion arose between the two companies; in the meantime, in conjunction with the Beaver Consolidated Mines we obtained figures as to what it would cost to install a plant to generate sufficient power to take care of both properties, should it be necessary to do so. However, arrangements have been made so that operations will be continued temporarily under practically the old conditions.

We have deemed it advisable not to sell our bullion at the present prices (the lowest for years) and are storing the same in London and New York, against which we can borrow money at any time to pay current expenses.

June 30, 1915—	ozs.
Bullion in storage	442,701.22
Due from smelters	187,568.90
Ore bagged at mine	100,000.00
Total	730,270.12
(Loan obtained on bullion security, May 8th, $30,000.)	
June 30th, 1915—	
Cash on hand	$223.69

GRANBY CONSOLIDATED.

Granby Consolidated Mining, Smelting & Power Company has entered upon what promises to be a record-breaking year. Its fiscal period ended June 30 last with improved operations and earnings, while since the first of July deliveries of copper at or near the highest prices have started.

The entire battery of eight furnaces at Grand Forks has been blown in and the Hidden Creek smelter has been tuned up to capacity, giving the Granby Company a monthly production approximating 4,000,000 lb. of copper.

In May the new Hidden Creek smelter commenced to show its speed. In that month it turned out for the first time more than 2,000,000 lb. of copper, besides an increasing amount of gold and silver. The old plant at Grand Forks also gave a good account of itself.

Granby's operations during the past few months have run as follows (lb. of copper):

	Grand Forks		Hidden Creek	
	1915	1914	1915	1914
January	775,786	1,793,840	1,349,353	.....
February	1,029,885	1,661,212	763,488	.....
March	1,196,670	1,775,852	1,597,022	.....
April	1,392,510	1,692,102	1,678,827	440,767
May	1,662,398	1,669,334	2,021,717	773,960

The entire smelter at Grank Forks was not in operation during the month of May, but with increased capacity blown in June's final figures should record a gain over the preceding month.

The fourth furnace, installation of which was started about six weeks ago, should be ready for operation by the end of July, making available for steady runs three sections of the Hidden Creek plant. This will add materially to the production from that source.

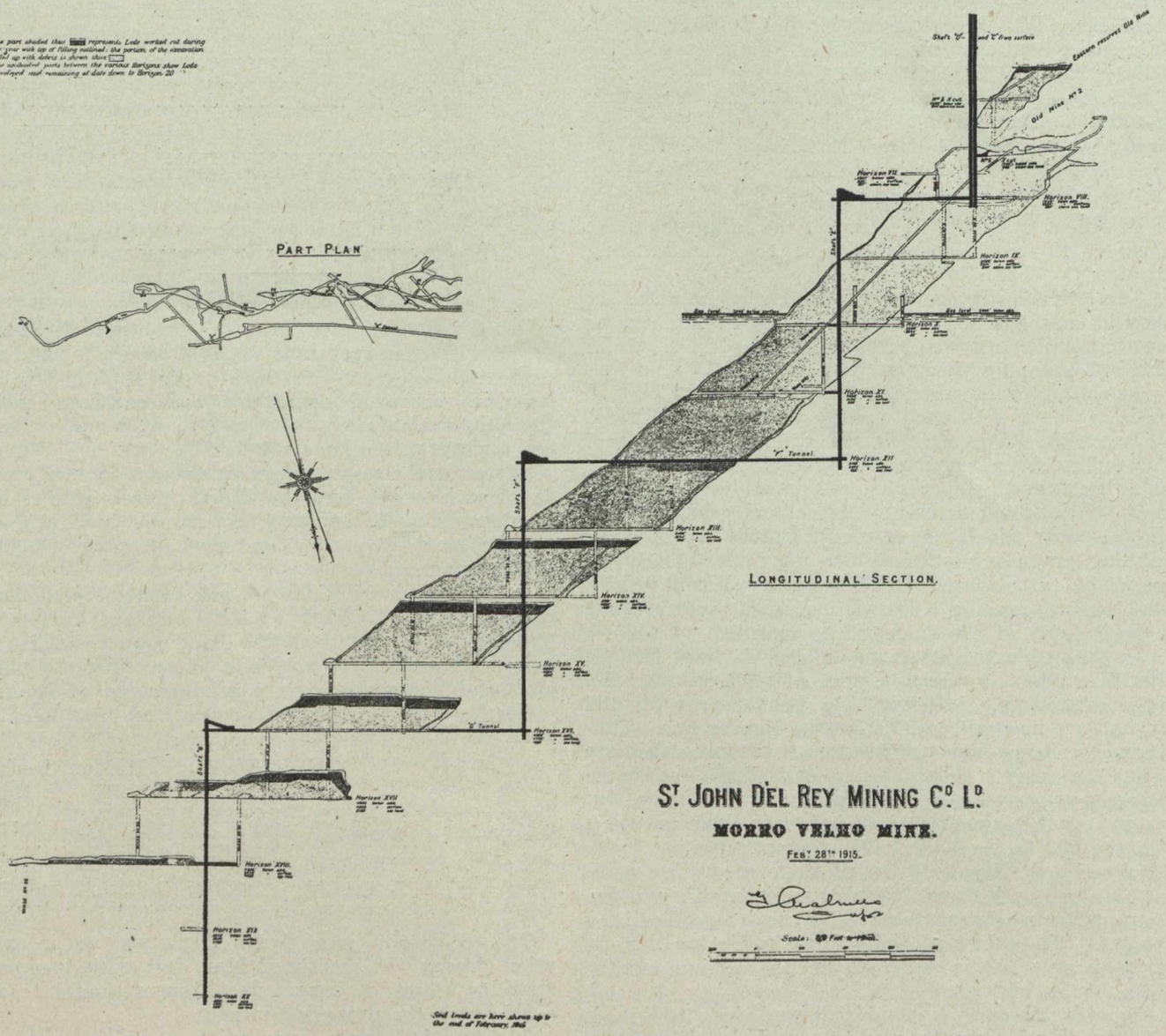
The agglomerator, installed at the Hidden Creek smelter to recover copper from flue dust, should be a factor very shortly both in increasing the amount of copper production and in lowering costs.

The Midas mine in Alaska, upon which nothing but preliminary work has been done to date, may be ordered on a productive basis, which task would take about a month.—Boston News Bureau.

VENTILATING THE WORLD'S DEEPEST MINE

By G. Chalmers, Superintendent Morro Velho Mine, Brazil.

Investigations in connection with ventilation at the Morro Velho mine, of the St. John Del Rey Mining Co., Ltd., substantiate previous reports that the system of distribution of the air, although meeting the case satisfactorily and in a most economical manner in the past, is becoming, as greater depth is attained, defective, and requires modification. Even when on rare occasions the downcast air at the bottom of the mine is comparatively low in moisture, by the time it has passed over two horizons it has become saturated, partly from the watering of the ways to lay dust, the sweat from the bodies of workmen, and from the breath of the animals and men. Consequently the efficiency of the men on the stopes above must be considerably impaired; in fact, according to authorities on the subject, 86° wet bulb (which represents the conditions of, say, horizon 16, at any rate during the rainy season) is supposed to be the limit at which men can work with full efficiency, and as the mine deepens this will, of course, be more seriously felt. But by largely increasing the volume of air passing through the deepest explorations, and by leading the allotted quantity (after it has passed over the stopes of one horizon, or at the outside two) directly to the upcast and away to surface, instead of passing it over the stopes above as in the old and existing system, the best possible conditions will be obtained. Due to the fact of our now being in a much better position as regards the main-way into depth, namely, of its being in advance of the explorations, Captain Watts has proved that it is possible to work each block by one vertical winze only, and our calculations show that this one winze and a steel pipe of 3 ft. to 4 ft. in diameter, will, with the eastern paved air-way give ample ventilation to the stopes during the working out of a block of mineral. Consequently, one winze for mineral and filling to act as a temporary upcast, which during the working out of each block disappears as the mineral is removed, is sufficient for the mining operations, and by sinking another vertical winze from one horizon to the



other, never less than 50 ft. from the average line of the north wall of the lode, and some connecting tunnelling, a permanent return air-way will be formed at a cost no greater than that of the old system of working out each block with two vertical winzes and a western wood block air-way and the eastern paved air-way, as the large saving in the temporary western air-way in the form of a 3 ft. to 4 ft. steel pipe over the wood block air-way formerly used, is more than sufficient to pay for the tunnelling between the top of one permanent upcast winze and the bottom of the next, and that connecting the temporary winze with the permanent There is another advantage in this system, namely, that when it is completely established we have a second permanent way into depth from horizon 17 down. It was difficult to determine the point at which the improved system should commence, but for various reasons No. 23 winze offers the best opportunity for an independent upcast air-way, and consequently it has been decided that the new system should commence from this point.

The benefit of the proposed alteration in the ventilating system will not be felt on the blocks of mineral to be worked out from horizon 17 up, but from 17 down. Those of us who have been responsible for the re-opening of this mine from surface to its present depth of 5,826 ft. have had the opportunity of realizing the steady rise in temperature as the depth has increased and have been frequently reminded of the difficulties in store for the company, especially at such times when an inadequate volume of ventilating air had been passing over the stopes or through explorations, caused by the partial closing of air-ways, the failure of fans, or by the explorations progressing more rapidly into depth than the main ventilating system. However, for many years it was possible to keep down to a reasonable figure the temperature to which the miners were subjected, and it appeared that by increasing the volume this condition could be maintained.

Past and present methods of ventilating.—In the first place natural ventilation was sufficient, later, furnaces had to be adopted during the hot season to assist the natural ventilation. As the mine became still deeper a Capel fan was installed at the top of the upcast "C" shaft to ensure a more constant volume of air. Finally, a Sirocco fan of larger capacity was installed in place of the former, the output of which could be increased by additional power, when required. Besides this, auxiliary fans are used on all explorations beyond the main system.

The existing ventilating system, which is referred to above as not satisfactory at the present depth, was forced upon us at a time when a more elaborate one of an entire independent air-way from surface down, which naturally recommended itself, would have been too expensive. The former represented the cheapest means of ventilation, and until quite recently met the case satisfactorily, as long as the system and supply of air was not interfered with by the above-mentioned causes. However, as depth has been attained the necessity for modification in the distribution of the air becomes imperative if the mine is to be worked to a much greater depth, of which there is every probability, seeing that the lode has so far shown so signs of failure in size or value in the lowest explorations made upon it, and as also there is apparently no geological reason against its continuance in depth; and the prospects of this company being able to work it profitably to a great depth seem only to be limited by the measurable additions in cost of winding, hauling, handling, mineral and other engineering matters. All these increase a little more or less proportionally to the depth, with one exception, viz.: that of **increasing heat in depth, which has presented itself to our minds as by far the most important obstacle, that is to say, if it cannot be overcome by some satisfactory artificial means of cooling.**

It was in consequence decided some years back to institute investigations with the object of obtaining information as to the increasing air and rock temperatures and other factors that go to make against the miners' efficiency, and add to cost the deeper the mine is sunk. As regards the rock temperature, bore holes were made at the different horizons, or vertical depths, and the temperatures taken. For a considerable time, due to the holes being too shallow, or badly situated, and to our want of experience in the matter and somewhat unreliable instruments, our readings were only very approximate. Gradually, however, the conditions for performing this work were improved and our preliminary investigations from year to year went to show that **in spite of the increasing heat found at the moment of opening the rock the deeper we went, it gradually became cooler after it had been in contact with a current of ventilating air.** From the temperature readings we obtained of the rock at the moment of opening different horizons, we were able to construct a rock temperature grade as a guide to what we might expect in depth. Since then, other horizons in depth have been opened and our grade, as will be seen in the chart, agrees closely with the readings taken, with the exception of that at horizon 20, which is lower than it should be owing to the exceptional volume of ventilating air forced to that point by the auxiliary fans cooling down the rock before its real temperature could be taken.

As before stated, **without this rise in temperature from the rock and other causes, the probable running engineering expenses in working the mine down would not mean a very serious increase, and this has proved itself in practice as far as we have gone.** Supposing the lode continues the same in size and value to horizon 26 (a vertical depth of 7,626 ft.), it could be worked profitably to that point and even to a much greater depth, but from the grade on our temperature chart, the rock at horizon 26 would be no less than 126.5° Fahr. at the moment of opening, and supposing that the mine atmosphere derived from an abundance of air from surface were maintained, the very best result we might expect as regards temperature would be that represented by the black dotted line K on the chart, which we considered in the past showed probably the lowest limit of mean air temperature that could be attained after the workings were connected with the main ventilating system, as experience proved in the upper sections of the mine that that atmosphere had gradually cooled down a little more or less to that line. We have, however, of late realized from practice that the best we can now expect in the absence of artificial cooling would be as represented by the black line, which means that we are nearing a point where the efficiency of the men would be affected.

It will be seen from the chart that the rock that had been laid open and exposed to the ventilation for some time year by year fell to some extent, but it will be apparent that the deeper we went, the cooling effect of the ventilating air would become less efficient, as we were year by year largely increasing the rock area; but beyond certain reasonable limits we could

not increase the volume of the air, and consequently **unless the air could be artificially cooled on surface, advantage being taken of the operation to deprive it of some of its moisture, the possibility of working the mine to horizon 26 would be small,** unless the working hours were reduced by the introduction of four shifts in the place of three, which would not only mean a large direct increase in labor cost, but necessitate addition in house accommodation and other matters representing a serious item in an isolated place of this kind where all work is so costly. It was accordingly decided to make further efforts in obtaining more reliable information as regards this important question so as to arrive at the most economical and efficient means of reducing both the temperature and moisture of the atmosphere within the mine. We considered that the temperatures shown on the chart, although not absolutely accurate, were near enough as a guide for all practical purposes. **The increase of air temperature due to the air becoming more dense as it passes down the mine, as explained by authorities on the subject, and checked by us, showed under normal conditions an increase of 1° Fahr. for every 180 ft., whilst the increase in rock temperature is approximately 1° Fahr. for every 125 ft.**

There are many other causes for increase in temperature in the mine, viz., those due to the friction of the air, heat from machinery, lights, decomposition of mineral, heat from the bodies of men and animals, etc., but the heating effect from the rock, and that due to the compressing of the atmosphere as it descends into depth, are, in the case of this mine, the most serious, and it is evident that unless the air as it enters the mine is made considerably cooler than the average surface temperature, it would in descending into depth arrive at a point below the present bottom, where its temperature would not allow men to work. But if the air entering the shafts can be cooled to something very considerably below that of the normal atmosphere, and the supply is abundant and constant, the rock will be progressively cooled from surface down, and, as time goes on, the cooling by air will be more effective in the bottom of the mine than at the time of starting the plant. During the cold season an experiment was tried by night, when the temperature was considerably below the normal, in which a known volume of air was passed through a measured distance of the adit tunnel into the mine, the rock temperatures being taken throughout the distance of the tunnel and period of trial, and at the end of five hours it was interesting to find that a considerable fall in the rock temperature had taken place, and it would no doubt have continued to do so to some extent had it been possible to maintain a supply of cool air (which would be the case if artificial cooling were adopted; but as soon as the sun rose, the air became warmer and the rock rose again to its original temperature.

As before stated, **the drying of the air has always been considered necessary in conjunction with the cooling operation,** but its importance was not so fully understood until information was gained from a valuable paper by Professor John Cadman, and the writings of other authorities on the subject had come to our notice. Unfortunately, the drying of the atmosphere is somewhat antagonistic to a satisfactory solution of the dust question, which necessitates watering of the roads and stopes to keep down the dust. However, the proposed distribution of the air, previously referred to, will apparently do far more to overcome the dust trouble than the drying of the air will make against our efforts in this respect, as the allotted quantity of air, after passing one stope, or at the outside two, will go directly with what dust it has taken up, to the upcast and away to surface, instead of the present system in which the same air passes the bottom stopes, from thence over the remaining stopes, with some slight addition of fresh air at each horizon, but accumulating dust all the way, until it finally reaches the highest stope, and from thence goes to surface.

The actual necessities as regards cooling and drying to ensure that as greater depth was attained the miners would work in a perfectly healthy atmosphere (even more so than in the upper sections) having been appreciated, the next point to determine was where the operation of cooling and drying should take place. Some advice had been offered to the effect that it would be most advantageous underground, and it is true that some benefit would be derived from this; but the increase in mechanical appliances underground represents a serious obstacle to our particular form of mining operations, and, further, on account of our principal cooling agent (water) being found on surface in abundance, whilst underground there is very little, and that at a high temperature, it has been decided that the cooling plant should undoubtedly be installed on surface—namely, at the top of the "D" downcast shaft.

Mr. Eric Davies, whose duty it has been to carry out the investigations, has also been entrusted with the designing of a plant which we consider most suitable for the purpose, and careful study has led to the proposing of this plant, not for extreme cooling or drying of the air, but one in which each operation will be performed to the most economical point, at the same time making use of ordinary cooling appliances which in practice have long since proved their reliability in cold storage dry blast for furnaces and other installations, and in consequence it represents a thoroughly practical scheme, which will effectually remove the one serious obstacle against the company being able to work the mine to a great depth. It will, however, be placed before specialists on cooling installations before it be finally determined upon. As regards the necessary power for driving the plant, this is not excessive, amounting to approximately 400 h.p., and as to the provision of this power, with that of 200 h.p. for ventilation, and other additions necessary for the working into depth, it has been satisfactorily arranged for.

The mine captain considers the efficiency of the miners is very little affected so far, and the writer is inclined to think that men who have been used to the damp, hot climate of Brazil for some years are probably more capable of working efficiently in 86° wet bulb temperature than men in England accustomed to a damp, cold climate on surface. Often enough in the hot season here the change from surface to the bottom of the mine is only slight, but the change in England would of course be a far more severe trial. Even in the hottest places in the mine the contractors are eager to work twelve hours, and had it not been for our complying with this to some extent, we should have lost our men. It is, however, evident that in spite of the apparent possibility that this climate is favorable to the efficiency of men working in hot mines, eight hours is quite sufficient for steady workers at the present depth.

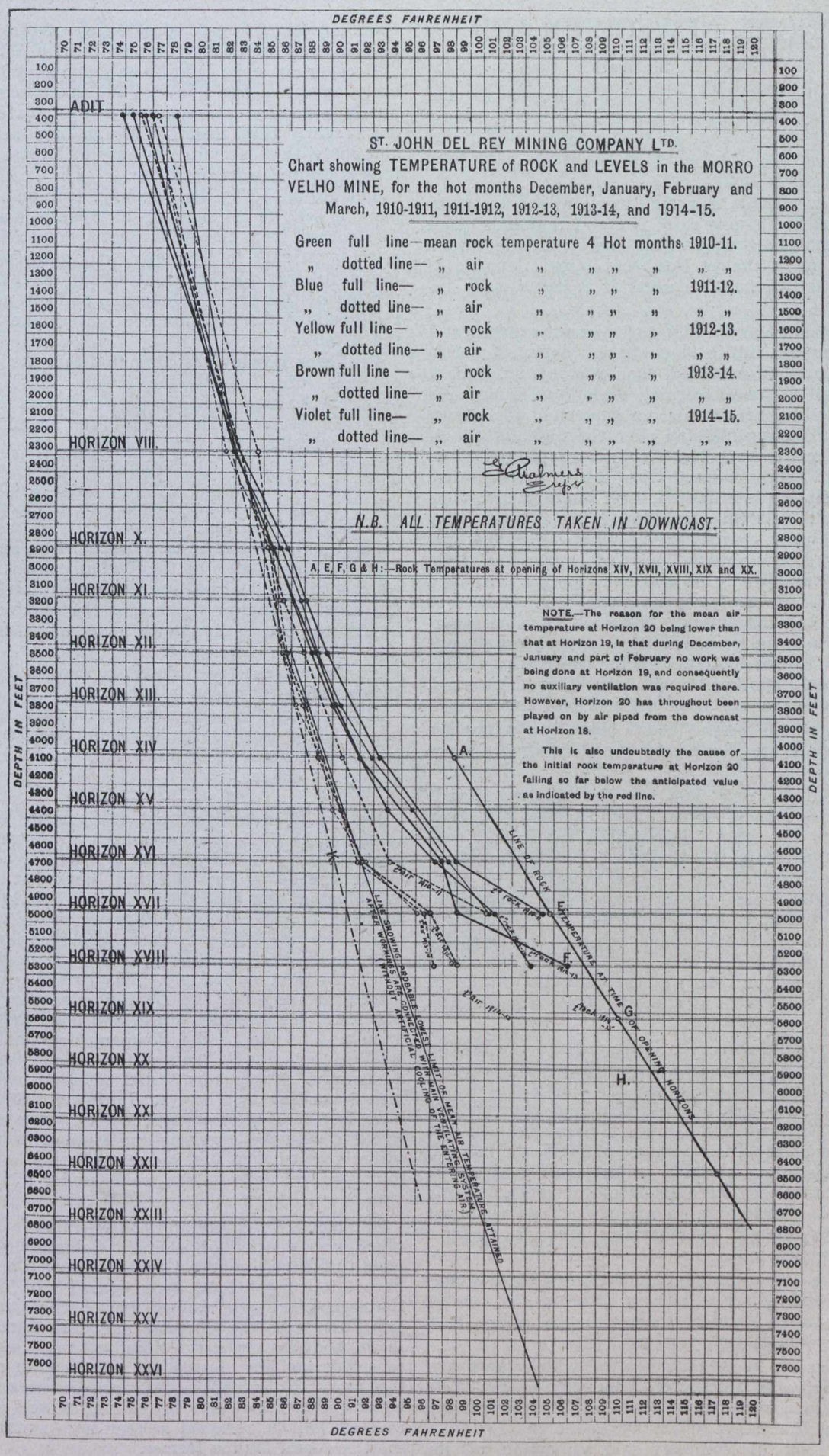


CHART SHOWING TEMPERATURE OF ROCK AND AIR AT DEEP LEVELS

N.B. The colors of the original are not here reproduced; but, except for the violet, lines are shown in black and duly labelled

MINING IN NEWFOUNDLAND

By J. W. McGrath.

Newfoundland wherever known is famed for her fisheries. Few have ever regarded her as a mining country, and yet, strange as it may seem, two of the richest copper and iron mines in the world have been worked for years there.

No one ever made scientific explorations to ascertain what minerals may exist in Newfoundland. That minerals were discovered at all was by mere accident. It was by mere chance that the copper deposits at Tilt Cove, and the iron deposits at Wabana were discovered.

Several years ago, in 1857 to be exact, a prospector for minerals, Mr. Smith Mackay, was engaged searching for mineral ores around the Newfoundland coast. The route of his travel led him to a village named Tilt Cove, where five or six families supported themselves by fishing. During his stay over the night at one of these fishermen's huts Mr. Mackay was surprised to find a large yellow colored rock, which rested as an ornament on the mantleshelf. On enquiry Mr. Mackay was told that the stone was taken from a large yellow cliff near by. The cliff when examined was recognized to be a great deposit of copper ore. On quantitative analysis being made the samples averaged about twelve per cent. copper alone. A mine was opened up, and the annual yield ever since has averaged fifty thousand tons, valued at approximately one quarter of a million dollars. In the contiguous village of Betts Cove, another deposit was later discovered, and with intervals has been worked ever since.

Over the whole district where these two mines are located, copper ores have been found in almost every village.

All around the coast and on the smaller islands around indications of copper may be observed, even extending to the coast. The writer has copper ore taken two years ago on Southern Labrador, which when analyzed yielded 28 per cent copper. The Newfoundland Government recently enacted a measure allowing bounties on copper ore smelted of 3½ per cent. on a sum not to exceed $50,000 for any one company owning annually for twenty years. All these lodes of copper ore are on tidal waters; what the interior of the country will reveal in mineral values is yet a closed book.

The other great mine of Newfoundland is the iron mine of Wabana. Here rests one of the greatest known deposits of iron ore in the world. The discovery of this ore was also merely accidental and happened in this way: The large and heavy red stones found along the beaches of the little village of Wabana had always provided very suitable ballast for fishing craft. On one occasion they were displaced for goods and left on one of the piers at St. John's; there they remained till a chance analyst disembarking from a steamer espied the stones, and judged them to be metalliferous.

Wabana is one of three islands occupying the centre of Conception bay and lies a little over five miles from the mainland, and here more than a million tons of hematite iron is yearly mined.

The ore exists in large bands, of which there are twelve, ranging in thickness from one to ten feet. First operations were begun here in 1895 by the Nova Scotia Steel Company, which worked alone for four years. In 1899 this company sold a portion of its claims, representing 28,000,000 tons of ore, to the Dominion Steel Company, for one million dollars.

Every year since both these companies have vigorously operated, five hundred thousand tons being annually mined by each company. Up-to-date apparatus has recently been installed for loading the ore boats, and one with a carrying capacity of fourteen thousand tons is easily loaded in a day.

The ore mined by the Dominion Iron and Steel Company is sent to its smelters at Sydney, Cape Breton. The output from the Nova Scotia mine always found a ready market in Germany, and undoubtedly much found its way to the great Krupp works. A large portion of this ore is submarine, and ore has been already mined for a distance of three miles out under the Atlantic.

Professor Howley has computed that the grand total of iron ore in all the bands now known to exist at Wabana, reaches the enormous amount of 3,635,543,360 tons. He says: "The amount that may be recoverable will largely depend upon the conditions met with, the engineering skill to cope with any difficulties that may present themselves, and the adequacy of the machinery employed to keep the mine dry and fully ventilated."

Mr. Moxham, a famous American iron and steel expert, declared that "at the Wabana mines the actual price of mining and putting the ore on cars is less than the usual contractor's price for the removal of earth, in fact the ore is capable of being mined as cheap as dirt."

At the present time these two companies employ a staff of about fourteen hundred men.

It is a matter of some significance that the only two mines being worked in Newfoundland, two of the largest of their kind in the world, came into operation merely by chance.

Reports have been current at Spokane, Washington, to the effect that some prominent mine-owners operating at Burke, Coeur d'Alene district, Idaho, have secured control of the smelting works at Northport, Washington, and that they will establish there a lead-smelting industry. The Northport smeltery was built in the late nineties by Spokane men then largely interested in the Le Roi gold-copper mine at Rossland, B.C., chiefly to treat Le Roi ore. The British company that afterwards acquired the Le Roi mine also eventually purchased the smelting works, and until the suspension of mining by the Le Roi Company operated the works, smelting both Le Roi and custom ores. The Coeur d'Alene mine owners, now stated to have decided to commence smelting lead ores at Northport, are reported to have failed to agree upon a smelting rate satisfactory to them, with the large smelting company that has heretofore smelted their ore, so are arranging to smelt their mine product at reduction works under their own control.

Shipment of zinc ore and concentrates from mines in the Slocan district of British Columbia during the month of June are stated by the Nelson Daily News to have totalled 451 tons, as compared with 573 tons in the corresponding month of 1914. The chief shippers this June were the Surprise and Hewitt mines, while in June of last year the Standard mine sent out 541 tons, but not any during the corresponding month of this year. However, the Standard concentrator is now being operated, so shipment of zinc as well as lead concentrate will be resumed as soon as a suitable market shall be found for the former.

Canadian Mining Institute---Western Branch

The twentieth general meeting of the Western Branch of the Canadian Mining Institute was held at Rossland, British Columbia, on July 15. In the unavoidable absence of Mr. S. S. Fowler, chairman of the branch, Mr. M. E. Purcell, superintendent of the Centre Star group of mines, presided at the two sessions held.

At the morning session those present were welcomed first by the Mayor of Rossland, and next by Mr. Lorne A. Campbell, district representative in the Provincial Legislature.

After acknowledgments by the chairman, Mr. E. Jacobs read some notes on the Mineral Production of British Columbia in 1914, first dealing briefly with the province as a whole, and then giving some information relative to the proportion contributed by Rossland mines in particular, in regard to which he showed that while the value of the mineral production of the whole of West Kootenay district in 1914 was $6,311,205, the proportion of Trail Creek mining division—almost altogether from Rossland mines—was $3,456,610, or 53 per cent. of the whole. Further, the total value of the mineral production of West Kootenay for five years, 1910-14, had been $29,000,665, of which the proportion of Trail Creek division had been $15,835,094, or a little more than 54 per cent. As showing how important a position Rossland mines hold in the lode gold production of British Columbia, it was shown that out of a total of 1,273,238 oz. produced in the province during five years, 1910-1914, Rossland mines contributed 643,605 oz., or a little more than one-half.

Mr. L. A. Campbell spoke on the subject of "**Underground Lighting in Mines,**" dealing especially with coal mines, for which he advocated the use of the storage battery lamp. Carbide lamps as compared with candles underground in metal mines were discussed by Mr. Ernest Levy, manager for the Le Roi No. 2, Ltd., and Mr. D. Michell, of the Provincial Department of Mines, while the secretary mentioned the experience of the superintendent of the Hedley Co.'s gold mine, and read some notes by Mr. C. M. Campbell, superintendent of the Granby Co.'s copper mines at Phoenix, Boundary district, where carbide lamps had been found much more economical than candles.

A paper on "General Gold-Silver Milling Practice and Tendencies," by Mr. Chas. A. Banks, general manager for the Jewel-Denero Mines, Ltd., Greenwood, B.C., was read by the secretary, and was briefly discussed.

Evening session.—Dr. Chas. W. Drysdale, of the Geological Survey of Canada, read a paper in which he described the occurrence of molybdenite at Lost creek, Nelson mining division, and showed samples of the mineral he had obtained from the property which he examined last summer.

Mr. Dudley Michell gave particulars of the classes that had been formed at metalliferous mines in Kootenay and Boundary districts during the year that had elapsed since he commenced organizing them in the summer of 1914; also the number of oxygen-breathing apparatus and pulmotors now at the metal mines of the province and available for use in cases of emergency, and the number of men who had been trained in their use. Discussion followed in which Messrs. E. Levy, M. E. Purcell and E. Jacobs took part.

Mr. Levy gave some diamond drill costs at the Josie mine of the Le Roi No. 2, Ltd., Rossland, as follows: For 14,185 ft. in 1912, $1.69 a ft.; for 15,075 ft. in 1913, $1.67 a ft.; for 12,249 ft. in 1914, $1.64 ft. Questions were answered by Mr. Levy, who is of the opinion that diamond drilling by contract at other mines in Rossland camp has cost the mine owners more than drilling had cost the Le Roi No. 2, Ltd., in its mine.

There was some discussion relative to **Unworked Crown-granted Mineral Claims,** in the course of which parts of Mr. Norman R. Fisher's paper entitled "Stalemate in the Mining Industry of Ontario and its Remedy," published in the Monthly Bulletin of the Institute for May last, were read by the secretary, who also mentioned a paper on "The Paralysis of Mining Districts," presented by Mr. Edmund B. Kirby at the session of the American Mining Congress held at Goldfield, Nevada, in 1909. While the desirability of having mineral claims worked was admitted by all, some of the speakers presented the owners' side of the question. It was agreed that while the matter is not one in connection with which hasty action would be wise, there seemed to be a general feeling that there must eventually be a change in the direction of providing for working claims within easy reach of transportation and other facilities for mining.

Other subjects discussed were "Mining Camp Conditions" and "Technical Education at Night Classes in Mining Districts." In connection with the former, the advantages enjoyed by miners working in such camps as Rossland and the Bluebell on Kootenay lake, and provided by mine owners as well at the Nickel Plate mine in Camp Hedley, and the Britannia mine in Vancouver mining division, were pointed out, and the need for effort to improve conditions in mining camps where similar advantages are not enjoyed by the miners, was emphasized.

It was announced that the result of the ballot for chairman of the branch for the ensuing year had been the almost unanimous election of Mr. Thomas Graham, of Victoria, chief inspector of mines, there having been only one vote for another member.

First Aid and Mine-rescue.—On the afternoon of Friday, July 16, a team of miners from the Centre Star mine gave a demonstration of "First Aid to the Injured," and of Mine-rescue work. In connection with the latter, an empty store on Rossland main street was used as a smoke chamber, and the team wearing oxygen-breathing apparatus rescued a supposed injured and asphyxiated miner and restored him by the use of the pulmotor, and put splints and bandages on supposed injured limbs before carrying him off to the hospital. This demonstration was watched with much interest, being the first of the kind in any metal mining camp in the province.

AN AUSTRALIAN METAL EXCHANGE.

Melbourne, July 21.

An Australian metal exchange is to be established. This step will be taken in order, as Andrew Fisher, the Attorney-General, told the House of Representatives to-day, to bring to an end German influence regarding the disposal of Australian metals.

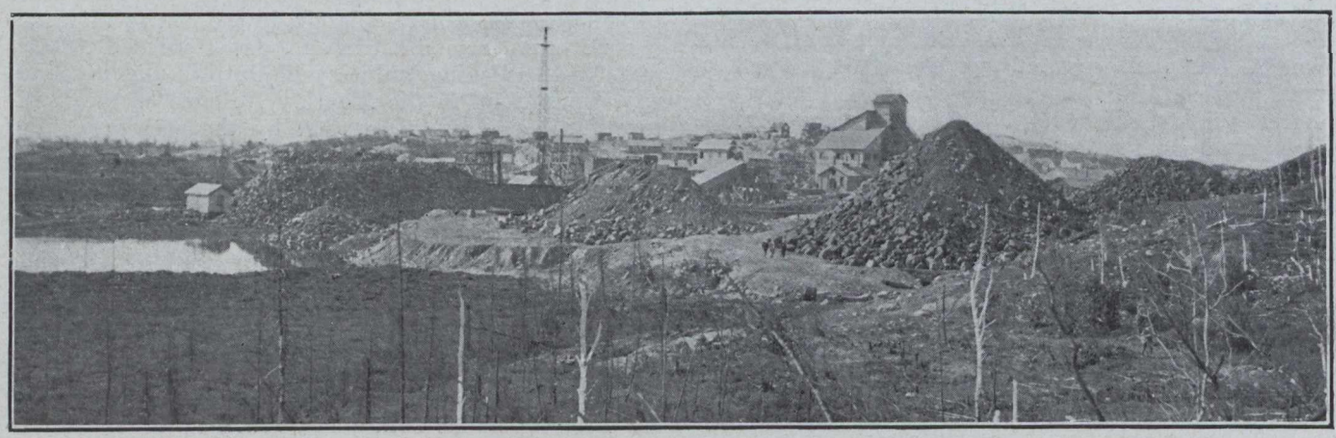
W. M. Hughes, the acting Premier, declared that the metal market was dominated by Germans, who, he said, had "bled Great Britain to the extent of millions of pounds sterling."

ONTARIO NICKEL COMMISSION

Hon. G. Howard Ferguson, Minister of Lands, Forests and Mines, has announced the personnel of the Government commission that is to investigate the nickel situation in Ontario in relation to conditions created by the war, and with a view to establishing in the province an industry to turn out nickel as a finished product.

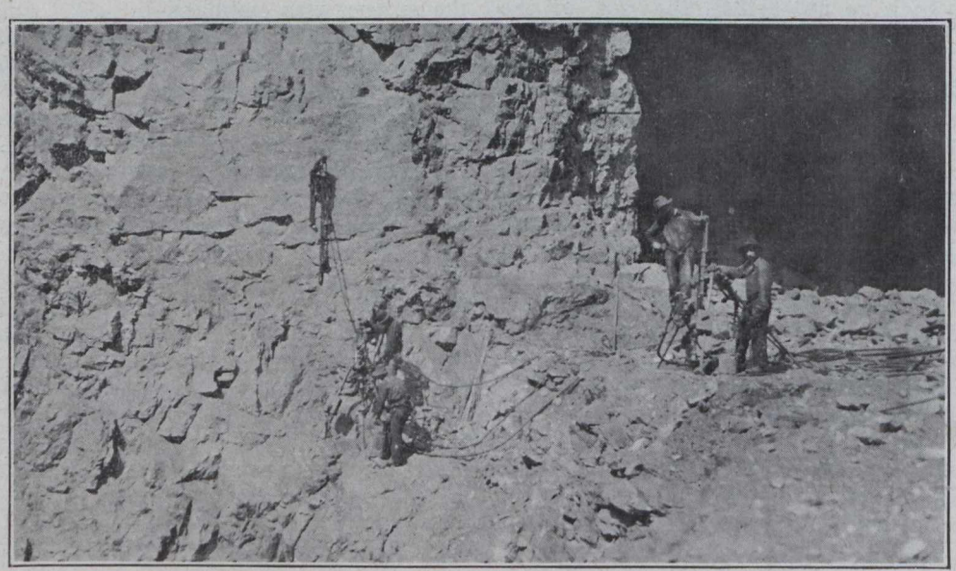
The chairman of the commission, who was recommended to the Ontario Government by the Imperial authorities, is George T. Holloway, A.R.C.S., of London, Eng., and associated with him will be Willett G. Miller, M.A., LL.D., F.R.S.C., the provincial geologist; McGregor Young, M.A., K.C., of Toronto, and Thomas W. Gibson, Deputy Minister of Mines.

The chairman of the new commission is now in England, where, at the request of the Government, he is making certain investigations and consulting with the Imperial authorities to secure their views in relation to the nickel requirements of the Government, and to the future policy of the Ontario Government with reference to the export of nickel. The other members of the commission are already engaged upon preliminary work. It is expected that the investigations of the commission will take close upon a year. During that time the commission will probably visit England and Norway, the latter country in order to look into a new electrical process for refining nickel that, it is thought, may be practicable in Ontario. The commission will also visit the New Caledonia mines in the South Seas in order to get first-hand knowledge of the quality and extent of the nickel ore bodies there. The New Caledonia ore fields are second to those of Ontario, but at present unable to compete to any extent. The purpose of the commission will be to determine what competition Ontario nickel will meet from this source if refining in Ontario raises the cost of the home products.



Creighton Nickel-Copper Mine

"While satisfactory assurances have been given to the Imperial authorities and the Dominion and Provincial Governments as well that none of Ontario's nickel is finding its way to the enemy, the Government views the situation from a larger standpoint," stated Hon. Mr. Ferguson, "and the commission will ascertain whether it is not possible to complete the refining of



Mining Nickel-Copper Ore, Creighton Mine

nickel ore from the mines of Ontario entirely within the province. The question of the province receiving an adequate return from its nickel deposits is also regarded as of much importance, and on this point the commission will also advise the Government.

"Our idea was that the interests of the Province of Ontario in this question were so linked up with those of the Imperial Government that we should not proceed without consulting them. Accordingly, after the Government reached the decision to appoint a commission we got into communication with the Imperial authorities and asked that they recommend a competent metallurgist, who might be chairman of the board. The time consumed in official correspondence has been responsible for the seeming delay, but as soon as the decision of the Imperial authorities was announced no time was lost in naming the remaining members of the board."

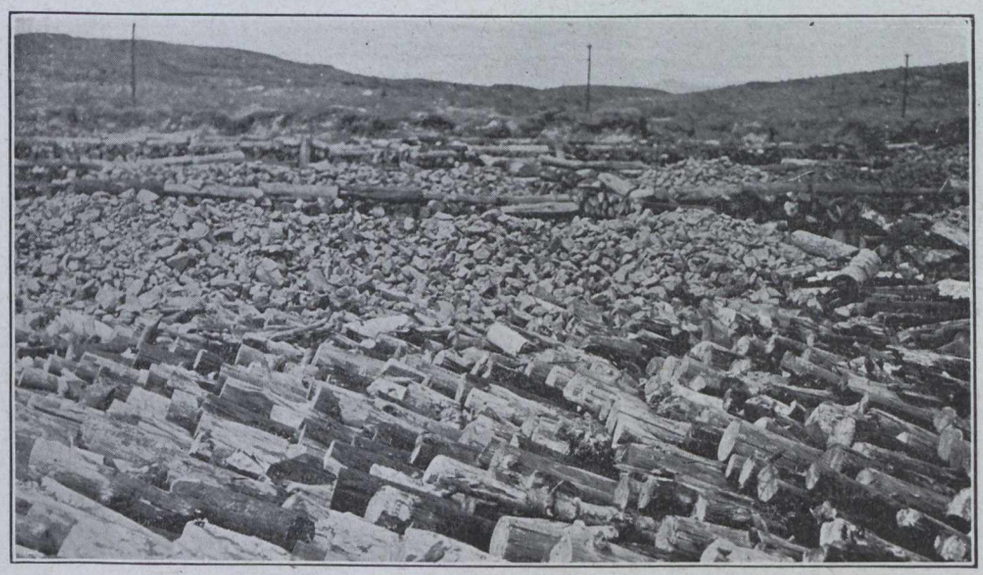
George Thomas Holloway, chairman of the commission, is an associate of the Royal College of Science, London; metallurgist and chemist; examiner in metallurgy, Institute of Chemistry and University of Birmingham; vice-president, Institute of Mining and Metallurgy, London. In addition to holding several fellowships, he is also a member of the Chemical, Metallurgical and Mining Society of South Africa; juror to the Franco-British and other exhibitions, and is adviser to the Egyptian Government.

Prof Willet G. Miller is regarded as the leading authority on the geology of Ontario and has rendered notable public service in working out the formations in various parts of the province. In recognition of his scientific services, he was awarded the gold medal of the Institution of Mining and Metallurgy of London early this year, which was presented to him a short time ago.

James McGregor Young, M.A., is professor of constitutional law and international law at Toronto University. He is a well known speaker and author, and has written several monographs on constitutional subjects.

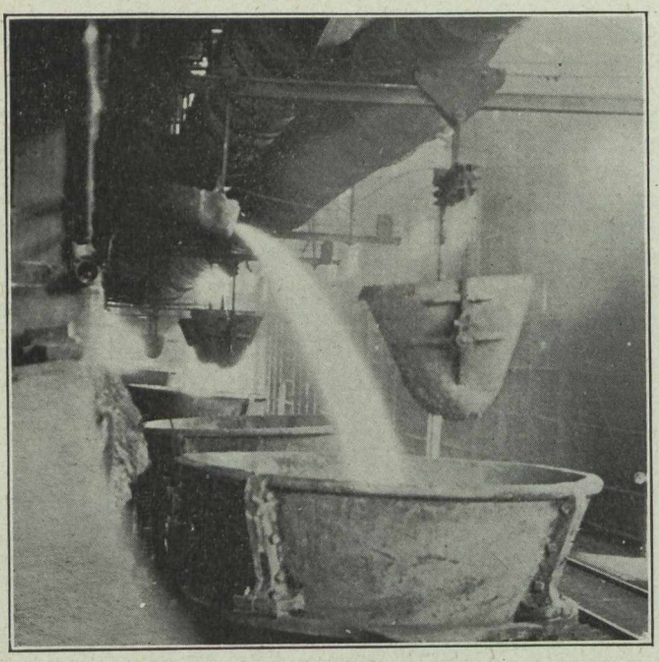
Thos. W. Gibson, Deputy Minister of Mines, has been connected with this branch of the provincial service since the Bureau of Mines was established in 1891. He is thoroughly familiar with the mining situation in the province. He was secretary of the Bureau of Mines under the late Archibald Blue, and on the reorganization of the department in 1906 by the present Government became Deputy Minister.

Apart from the local appointees, the care that has been exercised in the selection of the chairman of the Nickel Commission is shown in the following para-



Nickel-Copper Ore on Wood for Roasting

Roast Heaps Nickel-Copper Ore, Copper Cliff



Pouring Slag from Nickel-Copper Furnace

graph from a letter from Sir George Perley, Acting High Commissioner in London, who acted for the province in the negotiations: "I should like to add," said Sir George, "that very thorough steps were taken to obtain the name of a suitable man, and, in addition to making inquiries in other likely quarters, the Institute of Metals was approached. As a result, Mr. Holloway was recommended as eminently suitable for the position. I thereupon wrote Mr. Bonar Law submitting Mr. Holloway's name, and requesting that, before their decision was given, a careful investigation might be made as to his qualifications. Accordingly, at my instigation, the Colonial Office consulted the Admiralty, and ultimately advised me that their enquiries entirely bore out the opinion of the Institute of Metals that Mr. Holloway is a very suitable nominee for the position."

At the last session of the Legislature $15,000 was set aside to finance the investigation. The total outlay, however, will necessarily be much in excess of this sum.

RADIUM FROM CARNOTITE

Washington, July 27.

Secretary of the Interior Franklin K. Lane announced to-day that the production of radium from Colorado carnotite ores by the U. S. Bureau of Mines, in connection with the National Radium Institute, has passed the experimental stage in its new process and is now on a successful manufacturing basis. He also declared that the statements made to Congress concerning the ability of the Bureau of Mines to produce radium at a greatly decreased cost over other processes had actually been accomplished and that the costs were even less than predicted.

"The cost of one gram of radium metal produced in the form of bromide during March, April and May of the present year was $36,050, I am informed by Dr. Charles L. Parsons, in charge of the radium investigations of the bureau. This includes the cost of ore, insurance, repairs, amortization allowances for plant and equipment, cost of Bureau of Mines co-operation, and all expenses incident to the production of high grade radium bromide. When you consider that radium has been selling for $120,000 and $160,000 a gram, you will see just what the Bureau of Mines has accomplished along these lines.

"The cost of producing radium in the small experimental plant during the first few months of the bureau's activities was somewhat higher, but not enough to seriously effect the final average.

"The public, however, should not infer that this low cost of production necessarily means an immediate drop in the selling price of radium. The National Radium Institute was fortunate in securing through the Crucible Steel Company the right to mine ten claims of carnotite ores belonging to them and this is practically the only ore available at the time. Since then new deposits have been opened, but these are closely held, and according to the best judgment of the experts employed by the Bureau of Mines the Colorado and Utah fields, which are much richer in radium bearing ores than others known, will supply ore for a few years only at the rate of production that obtained when the European war closed down the mines. The demand for radium will increase rapidly, for the two or three surgeons who have a sufficient amount of this element to entitle them to speak from experience are obtaining results in the cure of cancer that are increasingly encouraging as their knowledge of its application improves. A few more reports like that presented to the American Medical Association at its recent San Francisco meeting and the medical profession as a whole, will be convinced of its efficacy. Under all the circumstances that have come to my knowledge it does seem to me that it behooves the Government to make some arrangement whereby these deposits, so unique in their extent and their richness, may be conserved in the truest sense for our people, by extracting the radium from the ores where its now lies useless and putting it to work for the eradication of cancer in the hospitals of the Army and Navy and the Public Health Service.

"The ten carnotite claims being operated at Long Park, Colorado, by the National Radium Institute have already produced over 796 tons of ore averaging above two per cent. uranium oxide. The cost of ore delivered at the radium plant in Denver has averaged $81.30 per ton. This included 15 per cent. royalty, salary of Bureau of Mines employees, amortization of camp and equipment, and all expenses incident to the mining, transportation, grinding and sampling of the ore.

A concentrating plant for low grade ores has been erected at the mines and is successfully recovering material formerly wasted. Grinding and sampling machinery has been installed at Denver and a radium extraction plant erected in the same city. The radium plant has now a capacity of three tons of ore per day, having been more than doubled in size since last February. Before that time the plant had been run more or less on an experimental scale, although regularly producing radium since June, 1914. To July 1, slightly over three grams of radium metal had been obtained in the form of radium barium sulphate containing over one milligram of radium to the kilogram of sulphates. The conversion of the sulphates into chlorides and the purification of the radium therefrom is easily accomplished and with very small loss of material. Unfor-

tunately, however, special acid proof enamelware, obtainable only in France, has not been delivered of sufficient capacity to handle the crystalization of the full plant production, so that a little less than half the output, or to be exact, 1,304 milligrams of radium element have been delivered to the two hospitals connected with the National Radium Institute. The radium remaining can be crystalized at any time from neutral solution in apparatus already installed, but the greater rapidity and efficiency of production of this very valuable material by the methods used have led the Bureau of Mines to await the completion of apparatus now being built before pushing the chloride crystalization to full capacity.

"The average radium extraction of all ore mined by the National Radium Institute has been over 85 per cent. of the amount present in the ore as determined by actual measurement. The amount present in the ore has been found in fact to be essentially the same as the theoretical amount required by uranium-radium ratio. The extraction figures for the last five carloads of carnotite treated has shown a recovery of over 90 per cent. in each case.

"A bulletin giving details of mining, concentration and methods of extraction is being prepared by the U. S. Bureau of Mines and will be issued early in the fall."

LABOR ORGANIZATION IN CANADA, 1914.

The fourth annual report on Labor Organization in Canada, containing 238 pages, embodying statistics, etc., for the calendar year 1914, has been issued by the Department of Labor.

Many will find a special interest in the chapter containing a discussion of the bearing of the European war on various aspects of trade unionism, which includes also the text of deliverances of representative labor organizations in different countries with respect to war in general or having special reference to the present war. Figures are printed showing the number of members of trade unions, who, to the close of the year 1914, have as recruits or reservists gone to the front from Canada. The trade unions furnished in all 3,498 recruits and 417 reservists, these figures not including recruits joining the forces since January, 1915.

The effect of the war on Canadian trade union growth is shown in a decrease of membership, the loss being 9,636. The estimated numerical strength of organized labor in Canada at the close of 1914 stood approximately at 166,163. The membership for each of the past four years, as reported to the Department, has been as follows:

1911	133,132
1912	160,120
1913	175,799
1914	166,163

The membership for 1914 of international organizations operating in Canada was 140,482, members of non-international bodies numbered 20,935, and 4,746 belonged to independent unions.

The decrease in international membership was 9,095, and in independent unions 1,261, while the non-international membership shows a gain of 720. At the close of the year 1914 there were 2,003 local branch unions in Canada, 1,174 owing allegiance to international organizations, 196 affiliated with non-international bodies and 33 independent unions. These figures show a reduction of 18 in local branches of international organizations, a loss of one in independent units, and a gain of five in non-international branches, making a total decrease of 14 in the number of local union branches in the Dominion.

A chapter is devoted to a discussion of some of the leading features of the organizations composed of workmen employed in the mining industry, including a brief history of their development and difficulties.

The report serves as a directory of trade unions for the Dominion for 1915, including as it does particulars not only of every known local trade union in Canada, but also a list of all international and non-international central organizing bodies, together with the names and addresses of the chief executive officers.

INTO BATTLE

By J. G., in "The Times."

The naked earth is warm with Spring,
And with green grass and bursting trees
Leans to the sun's gaze glorying,
And quivers in the sunny breeze;

And Life is Color and Warmth and Light,
And a striving evermore for these;
And he is dead who will not fight;
And who dies fighting has increase.

The fighting man shall from the sun
Take warmth, and life from the glowing earth;
Speed with the light-foot winds to run,
And with the trees to newer birth;
And find, when fighting shall be done,
Great rest, and fullness after dearth.

All the bright company of Heaven
Hold him in their high comradeship,
The Dog-Star and the Sisters Seven,
Orion's Belt and sworded hip.

The woodland trees that stand together,
They stand to him each one a friend;
They gently speak in the windy weather;
They guide to valley and ridge's end.

The kestrel hovering by day,
And the little owls that call by night,
Bid him be swift and keen as they—
As keen of ear, as swift of sight.

The blackbird sings to him, "Brother, brother,
If this be the last song you shall sing,
Sing well, for you may not sing another;
Brother, sing."

In dreary, doubtful, waiting hours,
Before the brazen frenzy starts,
The horses show him nobler powers;
O patient eyes, courageous hearts!

And when the burning moment breaks,
And all things else are out of mind,
And only Joy-of-Battle takes
Him by the throat, and makes him blind,

Through joy and blindness he shall know,
Not caring much to know, that still
Nor lead nor steel shall reach him, so
That it be not the Destined Will.

The thundering line of battle stands,
And in the air Death moans and sings;
But Day shall clasp him with strong hands,
And Night shall fold him in soft wings.

Flanders, April, 1915.

SMELTING WITH CRUDE PETROLEUM*

By Allan Bruce Marquand.

The investigations recorded in the following thesis apply principally to a general problem in metallurgy, namely, the elimination of sulphur dioxide and the control of flue dust in the smelting of base metal ores; but they also include the examination of a new furnace by which it is hoped this problem is to be solved, to determine its adaptability for this and other purposes as will appear later.

The two products of the present day smelter, sulphur dioxide and flue dust, have of late excited wide attention chiefly because of their deleterious effect upon vegetation and cattle in the vicinity of reduction plants and also because their production causes considerable loss to the operators themselves. Various plans have been suggested to control the flue dust losses and of these the "bag houses" seem to have met with the greatest success, although even this installation presents many objectionable features; but as yet no one has succeeded in eliminating the sulphur dioxide fumes.

Process.—The process used in this series of experiments was suggested by J. Heslewood and his son Wm. Heslewood, the inventors. Extended investigations with a somewhat similar furnace were carried on at Herault, California, and a brief description of the methods of operation and results obtained follows:

The ore is both desulphurized and smelted in one double compartment shaft furnace so arranged that after desulphurization has been carried to the desired point in the upper compartment the ore is dropped to the lower compartment and there smelted. Crude oil fuel is used for the double purpose of supplying heat and an important chemical reagent—hydrogen. Steam is admitted to both compartments to control the temperature in the desulphurizing zone and to furnish hydrogen and oxygen in both zones. The resulting furnace atmosphere is decidedly reducing; its nature being determined by the relative amounts of oil, steam and air admitted. The product passing from the desulphurizing into the smelting zone ranges from 6 per cent. to 8 per cent. sulphur.

The smelted products are slag to be rejected and a matte to be later converted. The passage of gases through the charge is due to a vacuum draught generated by a water-jet pump consisting of a centrifugal pump discharging through an especially designed vacuum chamber into a tank as shown in the illustration. Here all solid particles and substances which are condensed at this temperature are precipitated as the gases rise through the water. This solid material will be largely sulphur and unburned carbon, while the true gaseous products consist chiefly of carbon dioxide, some carbon monoxide, a perceptible percentage of hydrogen sulphide, a trace of sulphur dioxide and a small amount of sulphur carbon compounds, such as carbon di-sulphide.

The experimental observations upon which the foregoing statements are based follow with the chemical reactions which seem to most nearly explain them.

Preliminary experiments.—The first experiment was performed for the purpose of determining approximately to what degree hydrogen sulphide and sulphur dioxide united at various temperatures to give sulphur and water.

Hydrogen sulphide was generated by the action of hydrochloric acid on ferrous sulphide in a flask having three stopcocks; one leading to the atmosphere; one for the admission of acid and one in the tube passing into the combustion chamber, the latter being the only outlet open while the experiment was running. This gas was passed up through a large bottle containing wet, broken brick to remove any free sulphur which might be present.

Sulphur dioxide was generated in a similar flask by the action of hot, concentrated sulphuric acid upon metallic copper.

Both gases were dried through calcium chloride tubes, since water was looked for as an end product, and then led through a porcelain tube, referred to as the combustion chamber, one inch in diameter, which was heated by a series of bunsen burners. This combustion chamber was cemented with plaster of paris to a water jacketed condensing tube, through which the gases passed into the atmosphere after the possible precipitation of their content had been accomplished.

The results obtained were all that could be desired. Precipitation of sulphur and water started while the gases were at a comparatively low temperature, approximately 300 deg. C., and increased in amount until at a dull red heat, water was dripping from the end of the condenser, and a thick shell of elastic, amorphous sulphur had formed within. At this point during the first trial the amount of sulphur dioxide escaping had been very considerably reduced and the hydrogen sulphide had been practically eliminated, only a very faint trace being obtainable with lead acetate. It was evident, however, throughout this experiment, that an excess of sulphur dioxide was being generated. But a later run reversed these conditions and the sulphur dioxide was so reduced that the gases could be inhaled with no serious discomfort. Methyl orange, however, in a faintly alkaline solution, gradually changed color when subjected to the gases, indicating the presence of some small percentage of sulphur dioxide.

The equation representing the reaction occurring in this experiment is:

$$2H_2S + SO_2 = 2H_2O + 3S.$$

This experiment indicates that it is possible to reduce sulphur dioxide to free sulphur with hydrogen sulphide, and the method of supplying this reagent was the next point investigated.

Various possibilities present themselves. For example, assuming crude oil to be used as fuel, we have present a variety of hydrocarbons of which methane, CH_4, may be taken as a type, and a very probable reaction is indicated as follows:

$$SO_2 + CH_4 = H_2S + H_2O + CO.$$

The reduction of sulphur dioxide by means of hydrocarbon gases has been accomplished by other investigators, among whom might be mentioned Dr. Gotchalt of the United States Bureau of Mines.

*From the California Derrick, July 10, 1915.

Another possibility is that the methane and metallic sulphide in the presence of only enough oxygen to burn the carbon in the methane, may give results directly, as for example::

$$2FeS_2 + CH_4 + O = 2FeS + 2H_2S + CO.$$

But the reaction most desired was the formation of hydrogen sulphide by the action of steam upon the pyrite and this was the point investigated in the next series of experiments.

A combustion chamber similar to that described above, about one-half filled with crushed pyrite was connected as before to the condenser, and steam under three pounds pressure was led in through an eight-inch pipe.

The temperature was raised to an incipient red and held there for half an hour. A very notable volume of hydrogen sulphide was given off and some sulphur was precipitated, but no sulphur dioxide could be detected. These results apparently contradict those obtained by the Bureau of Mines in somewhat similar experiments, for here it is claimed sulphur dioxide was an end product. Differences in temperature and amount of steam used may account for the discrepancy noted. Upon examination of the remaining mineral it was evident that most of it which had been exposed to direct contact with the steam had been changed to the hydrous oxide of iron, $2Fe_2O_3$, $3H_2O$, indicated by a yellow stain. The remainder was left untouched or as a black sulphide, probably FeS.

A second run on pyrite at a dull red heat gave a much larger volume of hydrogen sulphide and considerably more sulphur, due no doubt to the distillation of the first atom. Very satisfactory results were obtained with commercial ferrous sulphide, FeS, although a simple equation, denoting the reaction, shows a consumption of heat on comparing the heats of formation, thus:

$$FeS + H_2O = H_2S + FeO$$
$$24{,}000 + 58{,}060 \qquad 4{,}800 + 65{,}700$$
$$82{,}060 \qquad 70{,}500$$

An equation showing the reaction with pyrite from which the free sulphur has been distilled might be as follows:

$$2S + 2FeS + 3H_2O = Fe_2O_3 + 3H_2S + S.$$

This also is a heat consuming reaction, but, because of the large excess of steam used the rapid removal of hydrogen sulphide and the plentiful supply of heat, the reaction went forward at a rapid rate.

All the possibilities considered and the results obtained from the foregoing experiments indicated that an experimental furnace was a necessity for further study. To obviate the necessity for two compartments, it was decided to build only one and to use it intermittently for roasting and smelting.

The furnace shell consisted of a six foot section of 36 in. water pipe and this was cut for flue, tuyeres, tap-notch and pyrometer pipes and lined with seven inches of fire brick, which left a twenty-two inch opening for the ore.

The vacuum chamber was designed to draw 150 cu. ft. of air through the furnace per minute and to create this draft a 6 inch Byron Jackson centrifugal pump, rated at 1,125 gallons per minute, was directly connected to a 30 h.p. Wagner motor. This pump required, theoretically, only 19 h.p., but to allow for all possible contingencies, 30 h.p. was considered to be none too much.

The flue from the furnace to the vacuum chamber was of 5 inch pipe, in which a gate valve was placed to control the amount of air passing through the charge. This was water-cooled by a sprinkler above, and the waste water was carried through the vacuum chamber to the tank. Below the gate a vacuum gauge was placed. This registered from zero centimeters, when the gate was open and no ore was in the furnace, to 76 centimeters, when the gate was closed.

The water tank was cylindrical and fitted with a partition between the openings to and from the pump. This partition came to within 2 inches of the water surface and served to prevent the return of water carrying gas bubbles to the pumps. A cover, tightly caulked, was put on the tank and bored to admit a 6 inch flue leading out of the building. Gas samples were taken from the top of the tank through small holes.

Furnace adjustments.—Preliminary runs were made as soon as the plant was complete, to determine the grade and amount of oil required, volume of steam to be admitted, temperature most desired and the possible range of temperatures.

These runs showed that a light grade of fuel oil was necessary because of the small burners used and about 15 gallons was consumed per hour. Two three-quarter inch pipes carrying steam under 4 lb. pressure gave very good results, but it was found necessary to keep the ore about 2 feet above the tuyeres and to use only one burner to keep the temperature below the melting point of the ore. The ore was held up by filling the furnace to this level with crushed limestone or magnesite. Between 900 and 950 degrees centigrade proved to be the most desirable temperature, and this was maintained during the latter part of our later runs.

Method of obtaining data.—It is obvious that if the results were to be of value, fairly accurate observations were essential and the nature of these is as follows:

The per cent. of sulphur in the ore was known and an analysis for sulphur was run on several samples taken after the run. The gas escaping from the tank was frequently sampled and tested for sulphur dioxide by measuring the amount of gas required to discolor an iodine solution of known strength. This is the usual method and is given in full in Dennis' "Gas Analysis," but is only accurate where hydrogen sulphide is lacking, for this gas will also discolor the solution.

When both these gases were allowed to pass through the solution, although the odor of hydrogen sulphide was noticeable, and the percentage of sulphur dioxide was calculated on the basis of the volume of gas passed through, this percentage was so low as to make a distinction between the two gases superfluous.

To return to the observations recorded:

During any of the runs, other notes made apply to the following; time of observations, temperature of furnace as recorded by a chrome-nickel pyrometer reading to 1,300 deg. C., vacuum on the furnace nozzle water pressure, steam used, etc.

The following data applies to the first trial giving good results.

April 22, 1915.

Charge—250 lb. sulphide ore averaging 46 per cent. sulphur.

Air pressure—41 lb.; steam pressure 4 lb.

Temperature readings obtained at a point 2 ft. above the bottom of the ore. Ore column 14 ft. high, bottom 2 in. above the tuyeres.

Start furnace 9.27 a.m. T equals 20 deg. C.

The temperature was below 700 deg. about a third

of the running time. The next third it was between 700 deg. and 800 deg. The highest temperature at the end of the run was 870 deg.

Total time 4 hours 23 minutes. Stops 29 minutes. Running time 3 hours 54 minutes. Oil used 60 gallons.

Gas Tests.

Time	Temperature Centigrade	Per cent Sulphur dioxide	Remarks on Hydrogen Sulphide
10.16	380	...	Trace with lead acetate
10.30	630	...	Trace with lead acetate
10.52	700	0.18	Rapid discoloration of lead acetate
11.13	695	0.12	Same
11.35	675	0.20	Same
1.45	860	0.20	Same

Sulphur in Calcines.

No. 1—Picked pieces, blackened, showing core of sulphides. Content 20.9 per cent. sulphur.

No. 2—Sample taken from close to the bottom of the ore column. Content 5.97 per cent. sulphur.

No. 3—Same as No. 2. Content 4.1 per cent. sulphur.

The furnace filler in this case was limestone and this was completely calcined, slacking violently when thrown into water.

Before the next run, the small 15 gallon oil tank was replaced by a 110 gallon drum in order to avoid the hourly stops for oil.

Tabulated observations taken during this run follow: April 24, 1915.

Charge and general starting conditions were the same as in the previous run. Started furnace at 1.30 p.m.

Time.	Temperature Centigrade	Vacuum Cm. Hg.	Water Pressure Lbs. per sq. in.
1.55	360	9	32
2.05	400	9	32
2.15	500	9	32
2.25	575	9	32
Started to add steam—gradually increased amount.			
2.35	560	9	32
2.45	600	9	32
Adjusted draft and oil to increase the temperature.			
2.55	700	25	30
3.05	850	20	30
3.15	925	30	29
Maximum steam supply on.			
3.25	965	31	29
Reduced the temperature.			
3.35	920	47	28
3.45	925	37	29
3.55	925	37	29
4.05	920	37	29
4.15	900	37	29
4.25	905	37	29
4.35	900	37	29
4.45	905	37	29
4.55	890	37	29
5.05	910	37	29
5.15	900	37	29
5.25	890	12	31
5.35	890	12	31
5.45	900	12	31
5.55	880	12	31

Total time, 4 hours 25 minutes.

No stops.

Oil used—50 gallons.

Gas Tests.

Time	Temperature Centigrade	Per cent. sulphur dioxide	Remarks on Hydrogen Sulphide
2.31	570	...	Good test
2.54	700	0.21	Strong test
3.26	965	0.12	Strong test
5.30	890	0.14	Strong test

The calcines obtained from this run, with the exceptions of a few pieces near the brick work at the top, were perfect in appearance, and analysis showed the sulphur content to have been reduced to from 3.9 per cent. to 5 per cent.

During all the runs made a thick, black precipitate was caught in the water tank consisting, for the most part, of unburned carbon and metallic sulphur. When dried, this burned readily with the sulphur flame, giving off quantities of sulphur dioxide.

An analysis made on similar material brought from Herault after the experiment made there showed:

Sulphur, 61.52 per cent.; silica, 4.94 per cent.; Ferric oxide, 15.12 per cent.; copper, trace; carbon, 20.0 per cent plus or minus.

The recovery of pure sulphur from this precipitate is a simple matter and requires no comment here.

Smelting.—During the preliminary runs such evidence of high temperature obtainable in the zone of fusion were noted as to make a special smelting run on the calcines unnecessary. In these runs fire clay, sulphide ore and lime were fused rapidly and, as already stated, it was only by cutting out one burner and the use of magnesite filling that a roasting temperature could be obtained in the space available.

Commercial Possibilities of the Process Applied to Sulphide Ores.

Considering the results obtained, with the possibility of commercial success for the process in view, it is a fact that no difficulties were encountered or suggested which were not easily overcome and that the desired results were satisfactorily accomplished. Furnace conditions easy to maintain and necessary adjustments throughout the operations were few, all being simple and involving no delay. All observations made seem to justify the development of the process on a larger scale and no doubt this action will be taken in the near future.

The complete plant herein described was designated for one special type of ore, but it was obvious that the basic principle embracing the vacuum draught and the perfect washing of the flue products resulting from this feature, might well be applied to the reduction of other ores requiring either roasting or smelting alone.

THE COPPER CLIFF BAND.

Elk Lake, July 16.

The Copper Cliff Band, which is the regimental band of the 97th Regiment, has remitted to Col. H. E. McKee, $116, proceeds of a concert given by the band at Copper Cliff. This money is for buying comforts for the members of the regiment in the trenches, and is being sent by the commanding officer to the front for that purpose. The Copper Cliff Band is one of the best bands in Ontario and took part in the musical programme at Toronto Exhibition last year. It is maintained by the Canadian Copper Company, and is a great acquisition to the 97th Regiment, the members being very public-spirited and enthusiastic musicians. Under the leadership of Bandmaster John Gribble, the organization has reached a high state of perfection.

McINTYRE-PORCUPINE MINES, LTD. ANNUAL REPORT

In a report issued on July 15, 1915, Col. Alex. M. Hay, recently elected president of McIntyre-Porcupine Mines, Ltd., says:

The directors spent a few days at the property in the early part of last month, and were very favorably impressed with the physical condition of the mine and the satisfactory operations being conducted at the mill.

The ore bodies, which on account of their lenticular character and owing to numerous faultings near the surface, have been very irregular in their occurrence in the levels so far worked, appear to be improving in size and values as depth is reached. It is reasonable to expect that after the faulted zone has been passed through, the ore deposits will be found to be more regular in their occurrence at greater depth.

A policy of aggressive development work will be pursued, and increased milling capacity will be installed as required, to keep pace with development of ore. No. 5 shaft has reached a depth of 500 ft. and a station cut. So soon as work has progressed to a sufficient distance from the shaft, sinking will be resumed to 600 and thereafter to 700 ft., which depth is expected to be reached before the end of the present year.

At No. 4 shaft on the 600 ft. level, ore bodies east and west of the shaft have been opened up, showing a width of from 12 to over 20 ft. of pay ore. This shaft will be sunk to the 700 ft. level after No. 5 shaft has reached that depth.

The production and profits for the last three months have been as follows:

	Tons Milled	Gross Value per ton	Recovery per ton	Recovery Total	Costs Total	Costs per ton	Net Profit
April ..	7,870	$8.32	$7.98	$62,820	$39,043	$4.96	$23,777
May ...	8,360	7.31	6.99	58,413	34,485	4.12	23,928
June ...	9,180	8.00	7.71	70,800	39,474	4.30	31,326

In view of certain statements recently circulated to the effect that the market in the shares of this company was being manipulated by insiders, I have made careful inquiries and find that neither any of the large shareholders or directors have been parties to such manipulation, if any. The directors cannot be responsible for any statements circulated without their authority. For the information of shareholders, and in their interest, official reports will be issued or published from time to time, setting forth the true position of the company.

Manager's report.—Mr. R. J. Ennis, manager, reports for the year ending December 31st, 1914, and for the period January 1st to March 31st, 1915, as follows:

The property of the company consists of 32.1 acres of land and 112.9 acres under Pearl and Gillies lakes, or a total of 145 acres.

Claim No.	Land	Under Pearl Lake	Under Gillies Lake
13307	23.6 acres	16.4 acres	
13308	8.5 acres		31.5 acres
"West McIntyre" 13963½ & 14373½		65.0 acres	
"Water Lot"			

Development work to date has been confined to Claim No. 13307, upon which are located the shafts, mining plants and mill. Exploratory work on the rest of the property has been limited to a study of geological conditions, surface trenching on the West McIntyre lot and to a diamond drill hole in the water lot, put down at the narrows in Pearl lake.

Production.—During the year 62,209 tons of ore was treated.

Average value per ton	$ 9.262
Extracted per ton	8.828
Tailing loss	.434
Gross value	576,217.60
Bullion produced and by-products obtained	549,255.42
Total loss in tails	26,962.18

Extraction. 95.3 per cent.

	Tons.
Ore mined in stopes during the year	63,786
Ore broken in development during the year	5,987
Broken ore reserves in stopes was increased	7,564
Ore hoisted during the year	62,613
Waste hoisted during the year	20,513

From January 1st to March 31st, 1915, 23,445 tons of ore was treated.

Average value per ton	$ 7.85
Extracted per ton	7.56
Tailing loss	0.28
Gross value	184,014.56
Bullion produced and by-products obtained	177,261.24
Total loss in tails	6,753.32

Since the beginning of operations to March 31st, 1915, the property has produced $1,020,250.34 in gold bullion, the result of milling 127,349 tons of ore.

Development.—The vein systems developed on the property may be classified as follows:

Veins in the basalt and grey schist and veins in the contact between the quartz porphyry and grey schist on the south side of Pearl lake.

No. 5 vein and veins in the contact zone paralleling the north contact between the quartz porphyry and the basalt on the north side of Pearl lake.

Veins in the quartz porphyry.

The workings of No. 1 shaft are located in the quartz porphyry. As the orebodies heretofore found in this formation have been erratic, both as to their occurrence and values, very little development work has been done on them within the year. A stope was started on a body of ore encountered in 303 and 304 drifts and 1,950 tons of ore milled. It was found necessary to discontinue running this ore into the mill, as it contains a large percentage of sericite, which settles very slowly, thereby reducing the capacity of the mill.

No. 2 and No. 3 shafts were originally prospecting shafts, and the work on the orebodies which they developed is now carried on through No. 5 shaft.

No. 4 shaft.—During 1914 100 ft. of sinking was done in this shaft, from the 400 to the 500 ft. level. In January and February, 1915, it was sunk to the 600 ft. level.

200 ft. level.—459 ft. of drifts and crosscuts were driven and 4,218 tons of ore drawn from stopes.

300 ft. level.—310 ft. of drifts and crosscuts were driven; 23,913 tons of ore were drawn from the stopes. The stopes on this level have produced 13,000 tons of ore more than was estimated as being available in ore reserves of April 1st, 1914.

400 ft. level.—1,663 ft. of drifts and crosscuts were driven on this level, and 16,257 tons of ore were drawn from stopes. 417 drift encountered the contact vein and it was driven on for 400 ft., showing a width of 5.25 ft., and assaying $12.44 for a distance of 300 ft. The quartz porphyry vein opened up in 303 and 304 drifts was cut on this level, showing a width of 4.1 ft. and assaying $6.00.

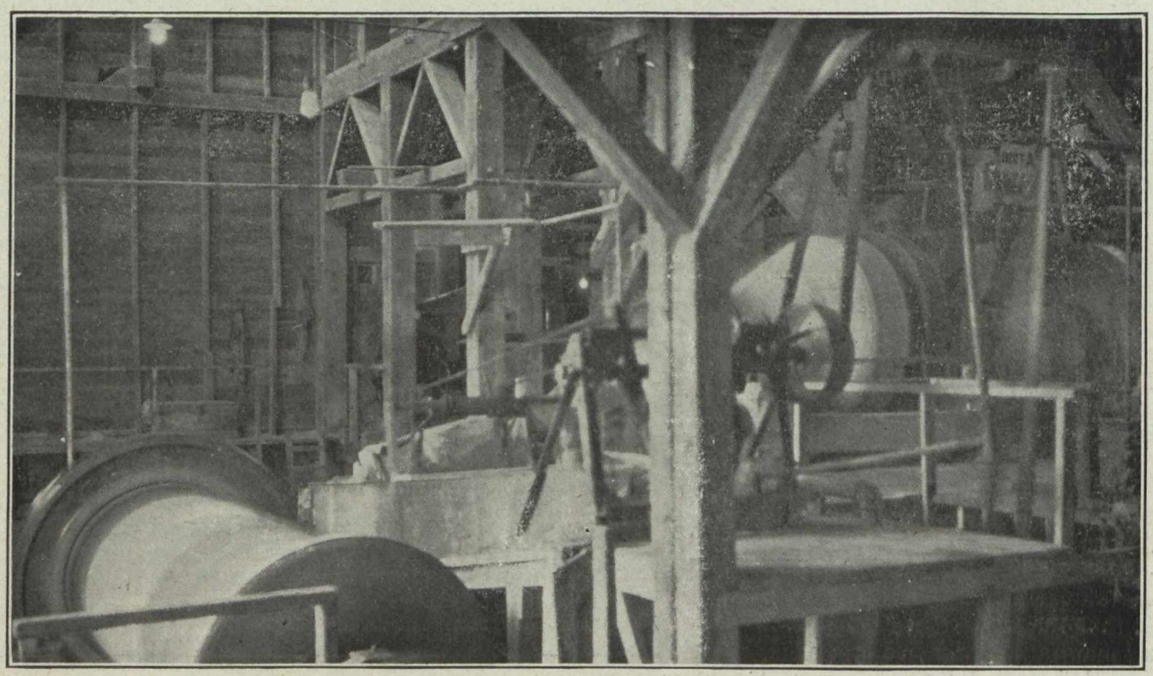
500 ft. level.—1,119 ft. of drifts and crosscuts were driven and 3,581 tons of ore drawn from stopes. Three new orebodies were opened up in the basalt on this level. The first in blocks I and J, 90 ft. long, assaying $11.50 over 4.5 ft., the second in blocks L and M, 60 ft. long, assaying $10.98 over 4.3 ft., the third in block M, 70 ft. long, assaying $4.66 over 4.4 ft. The contact vein was opened up in 517 drift for a distance of 240 ft.

600 ft. level.—500 ft. of drifts and crosscuts were driven. The west face of 611 drift at present shows 4.5 ft. of $4.00 ore, and the east face of 610 drift shows 20 ft. of $7.90 ore. The contact between the quartz porphyry and the basalt was cut 63 ft. north of the shaft, without any ore being found. 610 and 611 drifts will be continued east and west, and the contact to the north prospected with the diamond drill.

bodies of ore in the contact zone, and showing slightly higher value than on the 200 ft. level.

400 ft. level.—The shaft was completed to this level, and the station cut December 30th, 1914. From Jan. 1st to March 31st, 1915, 500 ft. of drifts and crosscuts were driven. From a study of No. 5 fault on the 300 ft. level, it had been determined that the No. 5 vein would be found south of the shaft. This was later proved by diamond drilling, when it was found that the fault had a throw of 130 ft. The vein was found with little trouble, and has now been drifted on for 170 ft., averaging 11.2 ft. in width and in value $8.43 per ton; at the widest part the vein is 43 ft. No stoping has been done from this level. A crosscut in block "C" driven south into the contact zone, cut 4.6 ft. of ore, averaging $8.23.

500 ft. horizon.—Diamond drill hole No. 47, put



Hardinge and Tube Mills, McIntyre Plant, Timmins, Ont.

No. 5 Shaft.

200 ft. level.—555 ft. of drifts and crosscuts were driven and 6,506 tons of ore drawn from stopes. Early in the year a diamond drill hole located the west extension of 215 vein; it proved to be a shoot of ore 125 ft. long, of good grade and extended up to fault No. 41.

214 drift was advanced to the east on No. 5 vein fissure, which contained only 1 inch of quartz. 100 ft. east of the shaft 214D raise was started on this quartz stringer, and at 40 ft. above the drift 3 ft. of ore was found; this ore is being stoped. 214E raise has, since January 1st, 1915, encountered the same ore body at 60 ft. above the 214 drift, and it is expected that the 215 vein will have a large easterly extension above this point. A crosscut from 214 drift in block F cut 4.2 ft. of $3.00 ore in the "North Contact Zone."

300 ft. level.—550 ft. of drifting and crosscutting was done on this level within the year, and 9,539 tons of ore drawn from stopes. Stoping operations in 314 and 315 stopes in the first part of the year were costly on account of the presence of faults No. 1 and No. 5. 314 drift was advanced to the east, locating several down at 35° from 412 drift on the 400 ft. level, cut No. 5 vein 12 ft. wide at 500 ft. below the collar of the shaft, and 20 ft. south from this vein penetrated 7 ft. of $12.80 ore in the contact between the quartz porphyry and basalt.

A crosscut from the east end of Pearl lake workings was driven 248 ft. into the McIntyre property in block H. No ore was found. On the 600 ft. level the crosscut from the Pearl Lake was continued to a point 550 ft. into McIntyre ground, this work was started for the purpose of connecting with No. 4 shaft, and to explore the ground under Pearl Lake. The last 100 ft. of this drive was in soft, swelling porphyry, and was difficult to hold with timbers. As the crosscut advanced towards the middle of Pearl lake, the quantity of water increased, and as it flowed from the face with some pressure, it was decided to discontinue the work. Concrete bulkhead was placed in the crosscut, and after being sealed for two weeks, the water behind it had reached a pressure of 200 lb. per square inch.

Exploration.

In 1913 it was recognized that the location of the orebodies on the south side of Pearl lake was con-

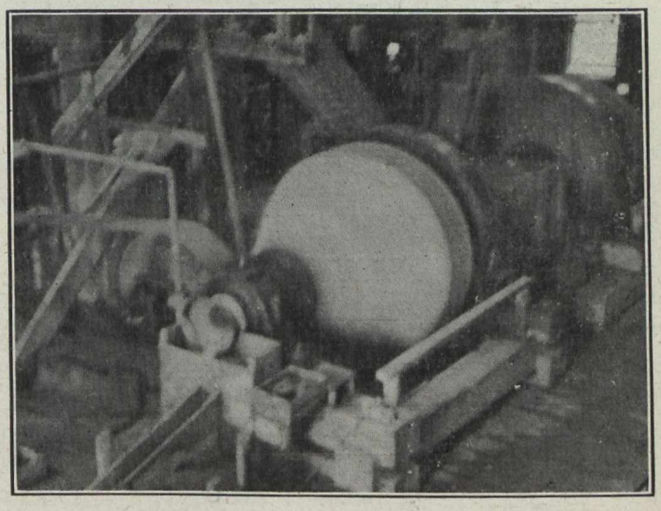
trolled by structural conditions, and that a close study of these conditions was necessary to carry on development work intelligently. A geological department was created at the beginning of the year to do this work and to assist in solving the serious faulting problems at No. 5 shaft. The work of the department has been successful, and it has placed in the possession of the company data and deductions that will be valuable for the future development of the property.

3,306.6 ft. of diamond drilling was done in connection with the geological work.

Ore Reserves.

Experience in developing and stoping the orebodies on the property has demonstrated that their form and occurrence render it impracticable to attempt to block out ore in the usual manner, therefore, the form and extent of the orebodies have been estimated from geological evidences supported by mining operations.

	Tons.	Value.	Per ton.
Estimated ore reserves, as of March 31st, 1915.	93,836	$741,218	7.89
Broken ore in stopes, as of March 31st, 1915	15,857	113,218	7.14
	109,693	$854,436	



Hardinge Mill, McIntyre Plant

Milling.

The ores of the property are remarkable in that they yield a larger per cent. of their gold content to the simple treatment of grinding them in cyanide solution, and giving them a short period of agitation. Our efforts have been to take full advantage of this fact and make the plant as simple as possible. In June work was started on a second unit of 150 tons capacity. This was completed in September at a cost of $55,000. The same process of treatment was used in the new unit as had been in operation in the old unit for 18 months, except that continuous counter decantation was installed instead of filters. The continuous counter decantation process proved entirely satisfactory, reducing the cost of treatment 13 cents per ton. In January, 1915, the filters in the old unit were discarded and the counter decantation system installed.

Conclusions.

During the year good progress has been made in solving the problems met in the operation of the property in the years 1912 and 1913.

Mine development has been satisfactory and continues to show steady improvement. Development work on the 500 and 600 ft. levels of No. 4 shaft proves these levels to be as productive as the upper levels. Lateral development on the upper levels continues to encounter new ore bodies.

The average width of No. 5 vein has increased from 6.5 ft. on the 300 ft. level to 12.5 ft. on the 400 ft. level with no change in values. This vein has been cut by diamond drill on the 500 ft. horizon, and is 12 ft. wide.

Three bodies of ore have been encountered by diamond drill in the north contact below the 300 ft. level. The north contact offers strong possibilities for payable ore bodies, and development work is now being done in this direction.

Underground and surface conditions are favorable for a steady improvement during 1915.

Operating Costs, McIntyre Mine, for Year Ending Dec. 31, 1914.

		Per ton of Ore Milled
General charges	$54,182.15	$87.10
Mining.	142,627.50	2.29.27
Mine development	98,663.55	1.58.60
Exploration.	2,597.02	04.17
Milling.	76,706.08	1.23.30
Maintenance, plant and buildings	4,992.65	1.23.30
Bullion selling cost	3,535.69	05.68
Interest and exchange	15,202.22	24.44
	$398,506.86	$6.40.59

Operating Costs for January, February, March, 1915.

		Per ton of Ore Milled
General charges	$12,959.20	$55.28
Mining.	51,380.26	2.19.15
Mine development	23,136.17	98.68
Exploration.	798.36	03.40
Milling.	24,648.07	1.05.12
Maintenance, plant and buildings	1,026.54	04.38
Bullion selling cost	1,209.64	05.16
Interest and exchange	2,614.75	11.16
	$117,772.99	$5.02.33.

Operating cost for the first quarter, 1915, showed a material reduction over the cost for 1914; this is due to the increased tonnage handled in the mill. Improvements under way will tend to further decrease mine costs. Costs shown include all charges except depreciation of plant.

Milling Record, McIntyre-Porcupine Mines, for Year 1914, and from January 1st to March 31st, 1915.

Month 1914.	Tons Milled	Average Value	Gross Value	Bullion Production and By-products obtained	Extraction
January	3,985	$7.19	$28,652.15	$27,027.17	
February.	2,880	9.22	26,553.50	24,368.56	
March.	4,325	12.68	54,841.00	51,853.78	
April.	4,215	11.70	49,315.50	46,210.67	
May.	4,480	11.10	49,728.00	50,140.56	
June.	4,390	10.65	46,753.50	43,429.27	
July.	4,850	10.35	50,197.50	47,705.78	
August.	4,240	10.82	45,907.00	44,174.59	
September.	5,530	8.25	45,622.50	42,599.04	
October.	7,510	8.84	66,388.40	63,327.11	
November.	7,670	7.59	58,221.00	55,656.15	
December.	8,134	6.64	54,037.55	52,762.74	
Total.	62,209	$9.26	$576,217.60	$549,255.42	95.3%
1915.					
January.	8,135	6.97.5	56,743.26	54,274.93	
February.	7,090	8.27	58,634.30	56,038.44	
March.	8,220	8.35	68,637.00	66,947.87	
Total.	23,445	$7.85	$184,014.56	$177,261.24	96.3%

Expenditure for Building Plant and Equipment, from January 1st, 1914, to March 31st, 1915.

Buildings and Equipment.		
Bunkhouse and equipment	$2,640.45	
Dry House at No. 4 shaft	1,520.26	
Dwelling Houses	1,532.61	
Oil house and equipment	1,148.64	
Miscellaneous	775.75	
		$7,617.71
Plant and Equipment.		
Cyanide mill (buildings and equipment)	$64,417.14	
No. 1 power house and equipment	94.12	
No. 4 power house and equipment	861.41	
No. 5 power house and equipment	467.20	
No. 4 shaft house	162.48	
Refinery (building and equipment)	1,000.90	
Assay office (building and equipment)	301.10	
Aerial tram	193.24	
Compressor and air equipment	1,305.42	
Mine equipment	16,725.37	
Pump house and water lines	182.99	
Machine shop equipment	1,356.82	
Blacksmith shop and drill sharpener equipment	2,497.22	
Electrical equipment	727.03	
Tramways	1,073.72	
Tools and steel	1,610.64	
Fire equipment	1,270.56	
Mill storehouse	396.94	
Surveying instruments	355.20	
Heating equipment	279.54	
Telephone equipment	277.13	
Miscellaneous	174.63	
		$95,730.80

Balance Sheet, McIntyre-Porcupine Mines, Ltd., March 31st, 1915.

Assets.

Capital Expenditure—		
Mining properties		$2,404,378.70
Plant—brought forward from 1913	$324,956.49	
Less adjustments	1,402,75	
	$323,553.74	
Additions since 1st Jan., 1914	103,348.51	
	$426,902.25	
Less depreciation for 1914	32,245.67	
		394,656.58
Development brought forward from 1913	$209,812.28	
Less adjustments	304.52	
		209,507.76
		$3,008,543.04
Current Assets—		
Cash in bank and on hand	$1,842.50	
Accounts receivable	1,989.76	
Guarantee deposits	368.27	
Stores	44,472.63	
Charges paid in advance	7,317.53	
Bullion assets, etc.		
Bullion shipped and not paid for	$44,831.61	
Gold in slag—estimated and matte	1,959.55	
	46,791.16	
		102,781.85
Deferred Development charges		1,888.40
Discount on shares sold		205,492.50
Discounts on Bonds sold		9,000.00
		$3,327,705.79
Liabilities.		
Capital Stock—Authorized	$3,000,000.00	
Less in Treasury	13,015.00	
		$2,986,985.00
Current Liabilities—		
Accounts payable	$37,704.53	
Bills payable, bank advances	$57,000.00	
Trade	507.51	57,507.51
Wages		18,942.48
Unclaimed cheques		550.05
		114,704.57
First mortgage 7% gold bonds	250,000.00	
Less unsold	$107,000	
Less repurchased	88,500	195,500.00
		54,500.00
Reserves—		
For interest accrued on bonds	438.98	
Government tax, due Oct., 1914	500.00	
Government tax, due Oct., 1915	3,450.00	
For bad and doubtful debts	600.00	
		4,988.98
Surplus—		
Premium on shares sold re-invested in plant	9,747.00	
Less written off plant (part only)	9,747.00	
Profit and Loss account—		
Debit balance from 1913	35,661.35	
Add adjustments, 1913	7,464.62	
	$43,125.97	
Credit profits Jan. 1st, 1914, to March 31st, 1915	232,751.88	
	$189,625.91	
Less reserve for bad and doubtful accounts	600.00	
Less depreciation (bal.)	22,498.67	
	23,098.67	
		166,527.24
		$3,327,705.79

Operating Account, McIntyre-Porcupine Mines, for Period from Jan. 1st, 1914, to March 31st, 1915.

To General charges	67,141.35	
Mining	194,007.76	
Mine development	121,799.72	
Exploration	3,395.38	
Milling	101,354.15	
Maintenance, plant and buildings	6,019.19	
Bullion selling cost	4,745.33	
Interest and exchange	17,816.97	
Adjustment, 1914	201.87	
By bullion production		$718,331.71
Rentals		1,801.50
Cash discounts		72.96
Miscellaneous revenue		977.43
Discounts on bonds purchased		28,050.00
To Transfer to Profit and Loss	232,751.88	
	$749,233.60	$749,233.60

CANADIAN ZINC.

Ottawa, July 15.

Steps are likely to be taken to encourage zinc refining in this country, and the members of the Cabinet yesterday conferred with the Shell Committee in regard to the supply of zinc for the manufacture of Canadian shells. It was announced by General Hughes some time ago that this matter would shortly demand Government consideration.

Canada produces large quantities of zinc ores, but the refining is mostly done in United States plants. With the demand created by the manufacture of shells, the price of zinc rose rapidly. Canada will now need more and more of this metal as she engages more largely in the making of munitions.

The Government of British Columbia a few weeks ago appointed Judge Forin, of Nelson, a commissioner to inquire into the responsibility of mine officials in connection with an explosion that occurred at one of the mines of the Coal Creek colliery last January, when a mine inspector lost his life.

Chile Copper Company has made its first commercial copper and has shipped it direct to Europe. Daily shipments of ore to the mill are running about 4,000 tons against 10,000 tons, the capacity of the first unit.

PERSONAL AND GENERAL

Mr. Chas. A. Banks, general manager for the Jewel-Denero Mines, Ltd., left Greenwood, Boundary district of British Columbia, about the middle of July on an eastern trip.

Mr. Chas. F. Caldwell, of Kaslo, B.C., manager of the Utica silver-lead mine in Ainsworth mining division, is on a visit to Chicago and other places.

Captain Bruce, of Haileybury, serving with a British regiment at the Dardanelles, has been wounded, and is in London, to recuperate.

Mr. Oliver Cotter, Kingston, with the Queens Engineers, was wounded at La Basse.

Mr. John Gibbens, of the Calumet and Hecla staff, was married on July 17 to Miss Nellie Peterson, of Milwaukee, Wis.

The management of the Bayonne Casting Co. has been completely reorganized. Mr. J. F. McNamara succeeds Mr. W. E. Oakley as general manager.

The National Exposition of Chemical Industries will be held at the New Grand Central Palace, New York, during the week of September 20, 1915.

Dr. W. G. Miller and Mr. C. W. Knight are examining a pre-Cambrian area north of Lake Huron.

Mr. J. K. Cram, formerly in charge of operations at the Consolidated Mining and Smelting Co.'s Highland mine, near Ainsworth, B.C., is now superintendent at the company's Sullivan group lead mine in East Kootenay, succeeding Mr. C. H. McDougall, who has been transferred to Trail, where the company is making important additions to its smelting works.

Mr. Graham Cruickshank, of Rossland, B.C., has volunteered for active military service, and has joined the forces in training at Vernon, Okanagan district, in that Province.

Dr. Charles W. Drysdale, of the Geological Survey of Canada, recently proceeded from his camp in Lillooet district to Rossland, B.C., where he read a paper at the twentieth meeting of the Western Branch of the Canadian Mining Institute, held on July 15.

Mr. F. M. Handy, professor of metallurgy at the State College of Washington, Pullman, State of Washington, was in Nelson mining division of British Columbia, last month, conferring with Mr. Francis A. Thomson, head of the mining engineering department of the same college, relative to mining and ore-treatment problems at a gold property south of Nelson.

Mr. Robert R. Hedley, of Vancouver, B.C., is now at the Bluebell mine, Kootenay lake, West Kootenay.

Mr. G. P. Jones, general superintendent for the Hedley Gold Mining Company, which is operating the Nickel Plate group of mines, situated in Camp Hedley, Similkameen, B.C., was in Victoria early in July.

Mr. J. P. Keane, of Sandon, B.C., who with associates is operating the Ivanhoe concentrator as a custom plant and is there concentrating lead-zinc ores from Slocan mines, has returned to Sandon from a business visit to Spokane, Wash.

Mr. Harold Lakes, of Ainsworth, B.C., superintendent of the Silver Hoard mine, is about to take a trip to Southern California.

Mr. Andrew G. Larson, of Spokane, Wash., was in the Slocan district of British Columbia recently in connection with the resumption of mining work at the Lucky Jim mine, which is now being operated under his supervision.

Mr. N. E. Linsley, of Spokane, Wash., was at Ainsworth in July, examining mining property for Spokane owners.

Sir Richard McBride, Premier and Minister of Mines for British Columbia, has returned to Victoria after having been absent three months at Ottawa, New York City and in Europe.

Mr. J. W. D. Moodie, of Britannia Beach, B.C., vice-president and general manager of the Britannia Mining and Smelting Company, Limited, was in New York City last month conferring with his principals relative to important work in progress at the company's copper mine and concentrating plant in Vancouver mining division of British Columbia.

Mr. Harry W. Newton, who some years ago was on the staff of the Northport Smelting and Refining Company, which then treated the ore output of the Le Roi mine, Rossland, B.C., is now at a mine at Nighthawk, Washington.

Mr. Stuart J. Schofield, of the Geological Survey of Canada, now has his field camp on Woodberry creek, in Ainsworth mining division, British Columbia, where he was recently visited by Mr. W. L. Uglow, of Kingston, Ontario.

Mr. Robert H. Stewart, general manager for the Consolidated Mining and Smelting Company of Canada, Limited, left Trail on July 13 on a business trip to Eastern Canada.

Mr. J. S. Wallace, years ago office manager for the Le Roi Mining Company at Rossland, B.C., but since then with Messrs. F. W. Bradley and J. H. Mackenzie at San Francisco, California, spent several days of last month renewing old acquaintanceships at Rossland. He is now connected with mining operations in Juneau district, Alaska.

M. Beatty & Sons, Limited, announce that the control and management of the company has been changed. Mr. H. L. Beatty has been elected president, and Mr. A. O. Beatty vice-president and general manager. Mr. Harris T. Dunbar, of Buffalo, has been elected member of the board of directors. Messrs. V. R. Browning and B. F. Miles, directors, and R. A. Greene, general manager, who have had charge of the business for the past three years, have severed their connection with the company.

Captain Hart Martin, of the Coniagas mine, Cobalt, was presented with a giant leaf of silver, suitably engraved, on the 10th anniversary of the beginning of mining operations at the Coniagas. The presentation was made on July 15 by Major Leonard, president of the company.

Mr. L. B. Ames has been appointed mill superintendent at the Hollinger mine, Timmins, Ontario.

Mr. Julio Madero, mining engineer, brother of the late President Madero of Mexico, was married in Los Angeles on July 16 to Miss Carmen Garcia.

William T. Dunn, formerly tool steel expert for the Carpenter Steel Company, in Boston and New England, has been appointed by the International High Speed Steel Company, of New York, district sales agent for New England and Eastern Canada. Mr. Dunn is at present taking a trip through the Cobalt and Porcupine mining district.

Lieut.-Col. Cantley has been elected president of the Nova Scotia Steel and Coal Company.

Mr. A. R. Globe, of the Hollinger staff, was in Houghton, Mich., last week visiting the copper mines.

Mr. T. C. Trethewey, for some years on the staff of the Kerr Lake Mining Company, has enlisted in the British army as a sapper.

SPECIAL CORRESPONDENCE

COBALT AND SOUTH LORRAIN

Dividends.—According to figures which have just been published, it appears that the total dividends paid by Cobalt and Porcupine mines to the end of June, 1915, amounted to a grand total of $63,799,440.75; of this the two principal camps have contributed as follows:

Cobalt	$60,157,440.75
Porcupine	3,642,000.00

During the last two weeks the price of silver has not shown any gain whatever, and in consequence there is a general disposition to store bullion even if dividends have to be cut. Coniagas has set the fashion by cutting its dividend from six to three per cent. The Coniagas is almost a close corporation and therefore can cut dividends without much affecting the public. Other companies with a larger list of shareholders may hesitate to take this drastic step; but if the price of silver continues as low as it is they may be forced to adopt similar action.

Slag Cars, Canadian Copper Co., Copper Cliff, Ont.

That there is no general pessimisim as to the future of the camp is well illustrated by the interest taken in any old prospects that are available. The Trethewey Cobalt is negotiating a working option with the Rochester, and will no doubt carry the deal through.

Right of Way.—Good success is attending the efforts of the lessees of the Silver Queen and the Right of Way. At both of these properties, which have been abandoned as worked out by several different managers, a good tonnage of high grade and milling ore is now being mined. It is not anticipated that this good fortune will attend them for any length of time, but it is significant that after such thorough exploration as the mines were supposed to have been subjected to, these new orebodies could be found.

Shamrock.—A circular has just been issued by a New York brokerage house, which would lead to the belief that the Shamrock will very shortly be reopened. It is the intention to sell the 400,000 shares still remaining in the treasury at 25 cents a share to provide for further development.

Beaver and Temiskaming.—The situation in southeastern Coleman in regard to the Beaver and Temiskaming has been cleared up as far as power is concerned. The Power Company and Mr. F. L. Culver have arrived at an agreement whereby the company will give the Beaver and the Temiskaming power at the old rates for some time to come, at any rate. In a circular to shareholders of the Beaver, Mr. Culver makes this point clear; he also states that it has been definitely decided to sink the shaft on the Beaver through the diabase sill to the lower contact. The main shaft is already down to a depth of 1,000 ft., and it is believed that there will be at least another 600 ft. before the lower contact is reached. The statement shows that there is bullion in storage in New York to the amount of $259,480; ore in transit to the smelters $65,899; ore bagged at the mine $41,221, making a total of $366,601. There is cash on hand to the amount of $79,864.

Coniagas.—A very interesting celebration was held at the Coniagas mine on the 15th of this month. The occasion of the celebration was the completion of a decade of mining at the Coniagas. Just ten years previously Capt. Hart Martin had stuck the first pick into the famous Coniagas vein. It will be remembered that the Coniagas was prevented from working for about two years owing to litigation. Mr. Martin, who is now mine captain, has remained with the company ever since. On the 15th Major Leonard, president of the company, made a special trip to the north in order to give Captain Martin a souvenir in the shape of a giant leaf of silver. A small portion of the silver had been polished, and upon it was engraved the dates on which Captain Martin became shift boss and mine captain.

PORCUPINE AND KIRKLAND LAKE

The Dome.—The bottom levels of the Dome mine are exciting very general attention. No public statement has yet been made as to the excellent grade and width of the orebody which has been developed from the No. 2 shaft. It is known that a crosscut has been run 400 ft. in ore and that the grade will be very much higher than in the pit. A shaft is now down to the 700 ft. level and a station is just being cut. A big crusher is now on the ground and will be installed before the end of the month. All primary crushing will be done underground, and the transportation of the ore will be

greatly simplified. The higher grade of ore in the new orebody has not yet been reflected in mill returns, because only a small proportion of it is going to the mill. As a matter of fact only 200 tons per day is coming from development of the richer orebody and 600 tons is being taken from the pit. In spite of that fact, June was a record month for the Dome in every respect except grade. The tonnage was 27,200 tons, which is more than 1,000 more than any previous month. The bullion produced was $120,821, a few thousand dollars more than the previous record in January, 1914, and the grade was higher than it has been since the beginning of the present year. In this month at least 800 tons will be treated. Within this year the management confidently expects to treat 30,000 tons a month. When this record is reached plans will probably be drawn for an enlarged mill.

Vipond.—The sinking of the winze at the Vipond mine has been attended with very good results. At 30 ft. in the winze below the 300 ft. level the vein dipped out, but it reappeared at 90 ft., and has remained in the winze to 30 ft. below the 400 ft. level. The ore is by far the richest that has been mined in the Vipond. It is 6 ft. wide. The half yearly statement of the Vipond, which will shortly be published, is very satisfactory. It shows a net profit of $53,000. The mill heads run over $10 to the ton, while costs were down to $5.86 on a relatively small tonnage. Tonnage is now about 3,400 a month. Extraction has been raised to about 95 per cent. and costs are slightly less than $5.00 a ton.

Hollinger.—The Hollinger monthly statement shows reduction in grade. This is entirely owing to the new policy at the Hollinger of mining and sending to the mill all ore that can be treated at an operating profit. Costs now average about $3.50 a ton. Fourteen or 15 veins are now contributing to the Hollinger tonnage, and there are as many more that will yield profitable ore as the ground is crosscut. This, of course, runs down the grade. The new policy looks to a largely increased tonnage at the Hollinger, and there is no doubt that in the future the mill will have to be enlarged, though this improvement may not take place this year. The directorate has obtained the services of Mr. L. B. Ames as superintendent. He comes direct from the Goldfields Consolidated mill, of which he was in charge, to Porcupine. His record at Goldfields Consolidated is a most favorable one, and the directorate believe themselves fortunate in securing his services. Owing to the large increase in the extent of operations the Canadian Mining and Finance is building a new office for the Hollinger and its allied interests.

Porcupine Crown.—At the Porcupine Crown about 60 tons of tailings are being hauled into the mill and treated. These tailings run $3.15 a ton, and an operating profit of $2.45 can be made. As a consequence only 100 tons is required from the mine itself. It is anticipated that it will not be possible to treat the 12,000 tons of tailings before the ground becomes stiffened with frost, but most of the tailings will undoubtedly be treated this year. The ore at the bottom of the winze at the 600 ft. level is now looking much better than at any part of the winze previously.

Teck-Hughes.—The Buffalo Mining Company is sampling the Teck-Hughes gold mine at Kirkland Lake. The shaft has been dewatered and a thorough resampling is being made by the Cobalt Company. It is expected that if the deal is made it will be on the basis of actual control of the property.

Sesekinika.—As a result of exploration of the surface of Smith LaBine claims at Sesekinika, some 14 or 15 veins have been uncovered. These veins are narrow, but quite rich, and they have lent much more interest to the district as a consequence. Near Wolf lake some veins of zinc-lead ore are attracting attention. These veins appear to contain a fair width of high grade zinc and lead ore and they are now being sampled by Cobalt houses with a view to discovering if they are worth working.

BRITISH COLUMBIA

While complete statistics of mineral production in British Columbia during the first half of the year are not yet available, there is good reason to believe that a better showing has been made than earlier in the year seemed probable.

Cariboo and Atlin.—Late reports from Cariboo encourage confidence that the gravel-washing season in that district will be longer than was expected when the season's operations were commenced, for frequent showers of rain that fell in June and July have added appreciably to the water supply stored for hydraulicking. So far as known but little hot weather has yet been experienced in placer mining districts, the season having been unusually rainy instead, so that the light snowfall of last winter will not be found to prove such a serious drawback as had been feared it would do. It is thought that in the Atlin gold field the experience of the last two months has been similar to that above mentioned as that of Cariboo field, in which case there, too, the gravel-washing season will be prolonged proportionately.

East Kootenay.

A decidedly satisfactory increase in the weekly average quantity of ore produced at the Sullivan group lead mines for 28 weeks to July 15, inclusive, is shown by the figures representing the quantity of ore received at Trail from those mines. For that period of 1915 the total was 23,836 tons, an average of 851 tons a week, against 11,964 tons, or 427 tons a week for the corresponding period of 1914. Lately the work of driving a long crosscut adit, to provide a more convenient outlet from the mines, was commenced.

Ainsworth.—The expected considerable increase in work in this division has not yet been realized. Of the mines near the town of Ainsworth, only the No. 1 is being worked on as large a scale as before the war. A few men are employed on the Highland, but the Banker-Maestro group is still idle, and the Silver Hoard has not yet resumed regular shipment of ore. The small mine, known as the Early Bird, situated near the level of Kootenay lake, has not shipped any ore for two months. It is reported the Bluebell, across the lake from Ainsworth, will soon be regularly producing. The Florence Mining Co., of Spokane, Washington, is stated to have opened a considerable quantity of ore of milling grade on its Hope group, on Princess creek. The Gallagher, a promising property situated several miles from the town of Ainsworth, on which the owner, Mr. A. D. Wheeler, has done a deal of work, and which in past years has been a profitable shipper, is now being further developed under option of purchase by Spokane men. The Silver Hoard, nearer the town, recently sent several cars of ore to Trail. Some work is being done on properties on Woodberry creek. West of Kaslo there are five or six

mines on which operations have been resumed now that weather conditions are not unfavorable; of these the Cork-Province, Utica and Panama have sent out ore since the melting of the snow admitted of its being hauled or packed to the K. and S. Railway. Development work on the Whitewater group, owned by J. L. Retallack & Co., is affording employment to a number of men.

Slocan.—The Rambler-Cariboo, Slocan Star, Ruth-Hope group and Surprise, are all now on the producing list. Other mines around Sandon are being worked, but are not at present shipping ore. Of mines near Slocan lake, the Standard and the Hewitt-Lorna Doone group of the Silverton Mines, Ltd., are the chief ore producers at present, the Standard having in July resumed shipments of silver-lead ore to Trail after a suspension of production lasting about 11 months. The Lucky Thought, on Four-mile creek, and the Wake-

	Six months, 1915, tons	Six months, 1914, tons
From Mines of East Kootenay	21,675	10,766
West Kootenay—		
Ainsworth Division ..	2,924	10,167
Slocan Division	2,385	10,875
Nelson Division	1,831	14,076
Trail Creek (Rossland)	172,856	127,925
Lardeau	56	30
Boundary.	428	160
Kamloops.	236	...
Coast district	101	806
Total British Columbia.	202,492	174,805
Alberta.	10	...
State Washington, U.S.A.	15,125	8,667
Total of ore receipts..	217,627	183,472

Lake Louise and Victoria Glacier, B.C.

field, high up the mountain opposite the Hewitt and Van-Roi mines, is again receiving attention after having been idle several years. In Slocan City division, the Enterprise sends out an occasional car of ore, and the Ottawa once more has men at work on it.

Nelson.—The Fern gold mine, situated a few miles south of the town of Nelson, has again been bonded, as, too, has the Eureka copper mine, near Forty-mile creek. A few men are doing unimportant work on the Silver King, but no ore is being shipped now. The Venus and one or two other gold properties near the town are on the active list, but their operations are not large. In the southern part of the division, properties about Salmo, Sheep creek and Erie are adding to the sum total of production, several of these producing gold, while others ship lead ore.

Ore receipts at Trail.—The following table shows totals of ore receipts at the Consolidated Mining and Smelting Co.'s smeltery at Trail for the first half of 1915, also the figures for the corresponding period of 1914:

There were decreases in receipts of ore from Ainsworth (7,243 tons), Slocan (8,490 tons), Nelson (12,-245 tons), and Coast mines (705 tons), total 28,685 tons. Against these were the following increases: East Kootenay (10,909 tons), Rossland (44,031 tons), Lardeau (26 tons), Boundary (268 tons), Kamloops (236 tons), Alberta (10 tons), and State of Washington (6,458 tons), total 62,838 tons. The net increase for the six months' period was therefore 34,155 tons. The proportion of ore from the Consolidated Company's own mines was 188,116 tons in the 1915 period, as compared with 145,362 tons in that of 1914. Custom ores totaled 29,511 tons this year against 38,110 tons last year. It is probable that the figures for the second half of the current year will show a satisfactory increase in custom ore receipts as well as of the company's own ore, for several of the mines that were custom shippers last year up to the time of the outbreak of the war, but which shipped little, if any, ore during the first half of this year, are now either preparing to resume shipment of ore or have already

done so. Again, the company, having resumed work at its several mines in Ainsworth and Slocan divisions, may be expected to assist in making a better showing from those divisions during the remaining months of 1915. The increase this year from Rossland was altogether from the company's own mines, custom ore receipts from that camp having been nearly 2,000 tons less than in the first half of 1914.

The Granby Consolidated Co.'s mines are now shipping about 3,500 tons of ore a day to the company's smeltery at Grand Forks. The B. C. Copper Co. is stated to intend to have its copper smeltery at Greenwood in operation again before the close of July. The Jewel-Denero Mines, Ltd., continues to operate its Jewel gold mine and 15-stamp mill, situated near Long lake, eight miles from Greenwood. Prospecting work is being done on various mineral claims in Franklin camp, north fork of Kettle river. Farther west, up the west fork of the river, there has been a resumption of work on several properties, but not much ore is being mined there.

Hedley.—The outlook for the Hedley Gold Mining Co.'s Nickel Plate group of gold mines is stated to be better now than at any previous time in the history of this dividend-paying enterprise. More ore is in sight, and much of it above the average value of that mined there in recent years. The company is making important additions to the mill plant, a second tube mill and four large cyanide vats being included in the improvements being made. An extension of the mill building has been necessitated to provide for the additional plant. The company's hydro-electric power system put in last year has been giving satisfaction, everything connected with it having fully come up to expectations.

The Iron Mask Mine, near Kamloops, shipped between 200 and 300 tons of ore to Trail during six weeks to the middle of July.

The Monarch mine, near Field, on the C.P.R. main line, has been taken on lease or bond by some Vancouver men, who have already shipped a little ore from it to Trail.

Small lots of ore lately have been sent out from two mines in Trout Lake division, Lardeau district, but the production of that part of the province is not now nearly so large as it was some years ago.

NEW YORK

It is predicted that the American production of refined copper for the year 1915 will surpass the previous high year of 1912, when 1,253,000,000 lb. was obtained, and some authorities even say that the billion-and-a-half figure will be reached, in spite of the cutting off of Germany's quarter-of-a-billion-pound annual buying. Copper stocks are not booming abnormally, being not much higher than they would be usually with copper at 15 cents instead of 20 cents, as it is recognized the situation will not last.

The big Gary steel plant of the United States Steel Corporation, from practical idleness last winter is now climbing to nearly 100 per cent. capacity.

At the excellently-operated Newport iron ore mine at Ironwood, Michigan, a steam shovel loading ore from a stock pile during ten hours on a Saturday, recently filled 162 cars of nearly 8,000 tons capacity. Previous record on the Gogebic range was at the Colby mine, Bessemer, when 150 cars of an average of 42 tons to the car was loaded in 10 hours.

"Life," the American "Punch," and the most discerning of American weeklies, says, editorially: "The German situation is that of a bully, who, after forty years of incessant preparation, attacked Europe, was foiled in its first dash, has been held for a year from any decisive advantage, and is now struggling with every power it has to escape a just punishment for its intolerable aggressions." Again, "Uncle Sam is going to be neutral, no matter what happens—if every last cartridge goes to help the Allies, all the Germans leave the country, and Berlin surrenders."

Bethlehem Steel Corporation, which recently came into prominence in mining circles by its acquisition of extensive iron ore lands in Chile, whence it plans to bring ore through the Panama Canal to its plants in Eastern Pennsylvania, was nearly the only American manufacturer with equipment and ability for manufacturing munitions of war for several months from the outbreak of hostilities. It is estimated its common stock will earn 90 per cent. during 1915. In spite of the exceptional opportunities for war orders, most American manufacturers did not wake up to the situation until Bethlehem Steel Corporation had shown the way.

The American Institute of Mining Engineers is one of eight scientific associations which have been requested by Secretary of the Navy Daniels to name two members for the newly-created advisory committee on inventions, of which Thos. A. Edison is chairman.

The United States Steel Corporation, since its organization 14 years ago, has nearly doubled its capacity for manufacturing its different products, in spite of the fact that its officials have sought to be conservative, and have gone into new ventures with the utmost caution. Its pig iron capacity is now reported at 16,748,800 tons. Owing to Chairman Gary's objections war orders are being refused.

French ownership in American "porphyry" copper stocks is decreasing steadily through general liquidation of foreign-owned American securities.

John Hays Hammond, Jr., son of the world-famous mining engineer, who has been startling naval authorities with his inventions, is only 22 years old.

Thirty thousand five hundred miles, one-eighth of the railway mileage of the U. S. A., which has nearly one-half of the world's length of track, is now in bankruptcy. The condition is partially due to overdoing the "big-business" idea.

Spelter is in great demand, but zinc ore and concentrate are relatively plentiful. Smelters are overtaxed.

INTERNATIONAL NICKEL.

Accompanying activity and strength in International Nickel common are rumors that directors early next month will pay another 5 per cent. dividend on the common. In addition there is persistent talk regarding listing the company's stock on the Stock Exchange.

The company's business continues to increase from month to month, with June the best month on record, and the quarter ended June 30 showing earnings at rate of more than 20 per cent. per annum. Last year the company earned 13.31 per cent. on the common and paid 12½ per cent. in dividends.

The rapid increase in business is indirectly due to the war, which has caused abnormal demand for munitions and automobiles, in both of which nickel is used extensively. In addition the record high prices for copper, of which the company produced millions of pounds annually, have served to increase earnings

MARKETS

SILVER PRICES.

	New York, cents.	London, pence.
July 10	47⅞	22¾
" 12	47⅝	22⅝
" 13	47⅜	22½
" 14	47½	22 9/16
" 15	47½	22 9/16
" 16	47⅝	22⅝
" 17	47½	22 9/16
" 19	47½	22 9/16
" 21	47⅜	22 9/16
" 20	47⅜	22 9/16
" 22	47¼	22 7/16
" 23	47⅛	22⅜

TORONTO MARKETS.

July 24, 1915 (Quotations from Canada Metal Co., Toronto)—
Spelter, 30 cents per lb.
Lead, 7 cents per lb.
Tin, 45 cents per lb.
Antimony, 40 cents per lb.
Copper, casting, 22 cents per lb.
Electrolytic, 22 cents per lb.
Ingot brass, yellow, 13 cents; red, 15 cents per lb.

July 24, 1915—(Quotations from Elias Rogers Co., Toronto)—
Coal, anthracite, $7.50 per ton.
Coal, bituminous, $5.25 per ton.

NEW YORK MARKETS.

July 22, 1915—Connellsville Coke (f.o.b. ovens)—
Furnace coke, prompt, $1.70 to $1.75 per ton.
Foundry coke, prompt, $2.10 to $2.40 per ton.
Tin, straits, 36.87½ cents.
Copper, Prime Lake, 19.12½ to 19.37½ cents.
Electrolytic copper, 18.75 to 19.00 cents.
Copper wire, 20.50 cents.
Lead, 5.75 cents.
Spelter, 19.75 to 20.25 cents.
Sheet zinc (f.o.b. smelter), 27.00 cents.
Aluminum, 32.00 to 33.00 cents.
Nickel, 50.00 to 52.00 cents.
Platinum, soft, $40.00 per ounce.
Bismuth, $2.75 to $3.00 per lb.
Quicksilver, $92.00 to $94.00 per 75-lb. flask.

STOCK QUOTATIONS.

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

July 23rd.

New York Curb.

	Bid.	Ask.
Alaska Gold	34.00	34.50
British Copper	.62½	1.00
Braden Copper	6.87½	7.00
California Oil	172.00	175.00
Chino Copper	44.62½	44.87½
Giroux Copper	.50	1.00
Goldfield Cons.	1.31¼	1.56¼
Green Cananea	40.00	42.00
Granby	84.00	84.50
Inspiration Copper	30.50	30.75
International Nickel	159.00	160.00
Miami Copper	26.75	27.00
Nevada Copper	14.25	14.50
Ohio Oil	134.00	136.00
Ray Cons. Copper	22.75	22.87½
Standard Oil of N. Y.	185.00	187.00
Standard Oil of N. J.	399.00	400 00
Standard Oil (old)	1325.00	.....
Standard Oil (subs)	925.00	.....
Tonopah Mining	5.50	5.75
Tonopah Belmont	3.62½	3.87½
Tonopah Merger	23.00	24.00
Yukon Gold	2.50	2.75

Porcupine Stocks.

	Bid.	Ask.
Apex	.02½	.03½
Dome Extension	.21½	.22
Dome Lake	.23	.23½
Dome Mines	22.50	23.00
Foley O'Brien	.28	.31
Hollinger	25.90	26.25
Jupiter	.10	.10½
McIntyre	.51	.51½
Moneta	.05½	...
Pearl Lake	.00¾	.01⅛
Porcupine Gold	.00½	.00¾
Porcupine Imperial	.06½	.06¾
Porcupine Crown	.70	.80
Preston East Dome	.03	.03½
P. Vipond	.62	.64
P. Tisdale	.01	.01¼
West Dome	.07	.07⅛

Cobalt Stocks.

	Bid.	Ask.
Bailey	.02⅝	.02¾
Beaver	.30	.35
Buffalo	.35	.50
Chambers Ferland	...	.16½
Coniagas	4.00	4.25
Crown Reserve	.45	.48
Foster	.04	.04½
Gifford	.01½	.02
Gould	.00½	.00⅞
Great Northern	...	.02½
Hargraves	.01	.02
Hudson Bay	19.00	...
Kerr Lake	4.25	4.35
La Rose	.45	.55
McKinley	.20	.24
Nipissing	5.50	5.65
Peterson Lake	.22	.22½
Right of Way	.03½	.04
Silver Leaf	.02½	.03
Teck Hughes	...	.06
Temiskaming	.35¾	.36
Trethewey	.11½	...
Wettlaufer	.03	.06
Seneca Superior	...	.95

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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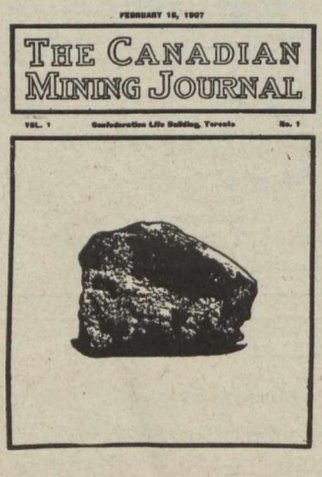

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REPORTS RECENTLY ISSUED:

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Memoir 59. Coal Fields and Coal Resources of Canada, by D. B. Dowling.
Summary Report of the Geological Survey for the year 1914.
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
Memoir 64. Preliminary Report on the Clay and Shale Deposits of the Province of Quebec, by J. Keele.
Memoir 72. The Artesian Wells of Montreal, by C. L. Cumming.
ONTARIO
Memoir 57. Corundum, its Occurrence, Distribution, Exploitation and Uses, by A. E. Barlow.
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 53. Coal Fields of Manitoba, Saskatchewan, Alberta and Eastern British Columbia (Revised Edition) by D. B. Dowling.
Memoir 65. Clay and Shale Deposits of the Western Provinces (Part 4), by H. Ries.
Memoir 66. Clay and Shale Deposits of the Western Provinces (Part 5), by J. Keele.
BRITISH COLUMBIA
Memoir 69. Coal Fields of British Columbia, by D. B. Dowling.
Memoir 56. Geology of Franklin Mining Camp, British Columbia, by Charles W. Drysdale.
Museum Bulletin 11. Physiography of the Beaverdell Map Area and the Southern Part of the Interior Plateaus of British Columbia, by Leopold Reinecke.
YUKON AND NORTH-WEST TERRITORIES
Memoir 50. Upper White River District, Yukon, by D. D. Cairnes.
Memoir 67. The Yukon-Alaska International Boundary, between Porcupine and Yukon Rivers, 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.
Map 49A. Orillia sheet, Simcoe and Ontario Counties, Ontario. Topography.
NORTH-WEST PROVINCES
Map 55A. Geological map of Alberta, Saskatchewan and Manitoba.
Map 117A. Wood Mountain Coal Area, Saskatchewan.
BRITISH COLUMBIA
Map 33A. Nanaimo sheet, Vancouver Island, British Columbia. Topography.
Map 70A. Victoria sheet, Vancouver Island. Geology.
Map 72A. Saanich sheet, Vancouver Island. Geology.
Map 109A. Prescott, Paxton and Lake Mines, Texada Island. Topography.
YUKON AND NORTH-WEST TERRITORIES
Map 113A. Canadian routes to White River District, Yukon, and to Chisana District, Alaska.

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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American Diamond Rock Drills.
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Northern Electric Co., Ltd.

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Can. Ingersoll-Rand Co., Ltd
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Sullivan Machinery Co.
Northern Canada Supply Co
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Boving & Co. of Canada, Ltd.

Continued on page 23.

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

Furnaces—Assay—
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Mussens, Ltd.

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Mussens, Ltd.
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Fraser & Chalmers of Canada, Limited
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Roberts & Schaefer Co.

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Northern Canada Supply Co.

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Peacock Bros.

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Locomotives—Electric—
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Jeffrey Mfg. Co.

Locomotives—Steam—
Mussens, Ltd.

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International Nickel Co.

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Northern Electric Co., Ltd.
Peacock Bros.

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Nickel—
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Boving & Co. of Canada, Ltd.
Consolidated M. & S. Co.
Peacock Bros.
Mussens, Ltd.
Northern Canada Supply Co.
Smart-Turner Machine Co.

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Mussens, Ltd.
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Mussens, Ltd.
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Fraser & Chalmers of Canada, Limited

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Smart-Turner Machine Co.

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Rope Wheels—
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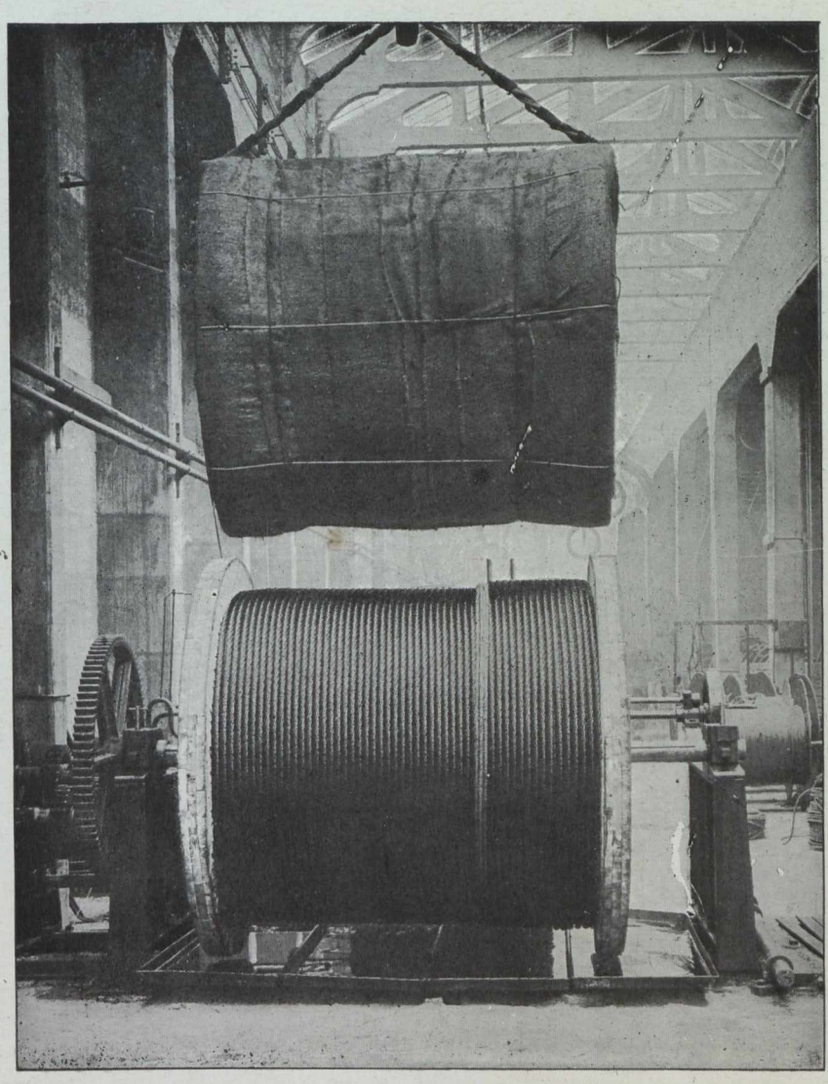

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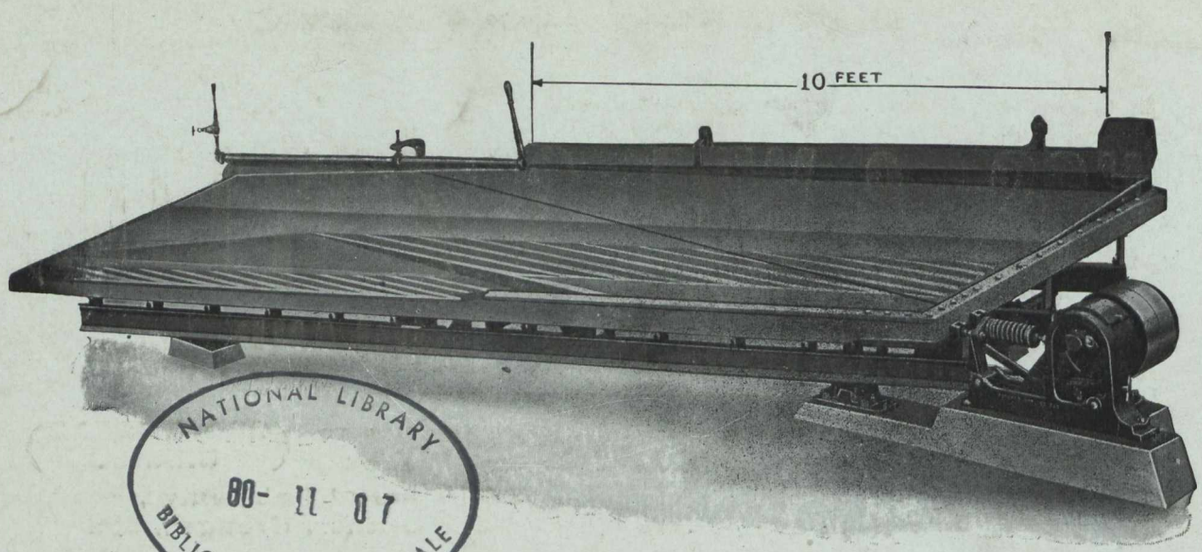

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