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## The Canadian Mining Journal

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### CIRCULATION

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## PRODUCTION IN 1916 SHOULD BE LARGE

It is becoming more and more obvious that production during the past year has been too small. A few men like Mr. Schwab realized early that the demand for metals and metal products would by this time be sufficient to tax the capacities of plants in the United States and Canada. The great majority of those responsible for the operation of mines and plants had less confidence in the future and became ultra conservative in their operations. In the early months of the war production was cut down owing to the uncertainties which the new conditions presented. Fear of the future markets deterred men from undertaking new ventures in industries in which metals are consumed. The lack of confidence naturally affected adversely the production of minerals.

During 1915 confidence has been gradually regained. The great demand for some metals early in the year resulted in increased activity in several mining districts. The good prices received for copper, aluminum, lead, and zinc and the fabulous prices obtained for rare metals such as quicksilver, antimony, tungsten, molybdenum, etc., have stimulated production and the search for minerals.

During the greater part of 1915 the prices of some metals were still low. The iron and steel industry was notably backward, but has recently experienced an almost unprecedented recovery. With a suddenness that has startled experienced steel men the industry has passed from dullness to extraordinary activity. The late summer has seen great increase in lake shipments of iron ore and now buying for 1916 has begun at an advance of 75 cents per ton. What this advance in price means to operators may be appreciated by considering that the iron ore shipments during 1915 from the Lake Superior district amounted to 46,318,804 tons. There is likely to be an increase in 1916 that will tax the capacity of the fleet.

More particularly affecting Ontario has been the low price of silver in 1915. It had been expected that production from the Cobalt district would be smaller than in previous years owing to the decrease in high grade ore. The low price which has ruled has, however, resulted in a very much larger decrease in production than would otherwise have been recorded. Recently silver mine operators have been delighted with an increase in price from 46 to 56 cents per ounce, and those who have been producing and holding the product have had a chance to sell at good prices.

Ontario's greatest mining district, the Sudbury nickel-copper district, after experiencing great changes in the



early months of the war is now producing much greater quantities of nickel-copper matte than ever in its history. There are more men employed at the mines and smelters, wages have been increased and the operating companies are making greater profits.

British Columbia's great copper mines are now being drawn upon at a rate which will help to make up for the falling off in the early months of the war. At Trail the production of gold, lead and copper has been increased and plant is being installed for the refining of copper matte.

The increase in gold production in Ontario in 1915 will be very large. The output in 1914 was \$5,529,767, while the total for this year will be about \$8,000,000.

The great improvement in the mining industry in 1915 augurs well for 1916. A year ago prices of most metals were still low and many seemed afraid or doubtful of the future. To-day high prices are the rule, and the demand is increasing. Confidence in the future is becoming more general. The signs all point to 1916 being a big year in the mining industry in spite of, and partially because of, the war.

It is a pleasure to be able to record such improvement as has taken place during 1915 and to so anticipate the future, for never was there greater need of production being large. The desirability of increasing production of grain during the war has appealed both to the agricultural population and to the people generally. The average person knows less about mining than about farming, and is not so likely to appreciate the fact that mining is a basic industry on which we can depend for the maintenance of our country's credit. It would be very desirable if the public could be made to realize that increase in Canada's mineral production is important for the general welfare. It does not mean only increased profits for operating companies. It means increased employment at good wages, increased markets for manufactures and farm products. Moreover, the production of minerals, whether profitable to the operators or not, is a direct contribution to the wealth of the nation. Why leave gold in the ground when it would command such high rates of interest as obtain in these days?

## COAL MINING IN AMERICA AND EUROPE

Very considerable interest has been created in mining circles in Great Britain by a paper read before the North of England Institute of Mining Engineers by Samuel Dean, in which Mr. Dean argues that the principal reason why America leads in the production of coal per man employed is because large capacity mine cars are used in the United States.

The Engineering Supplement of the London Times comments as follows, dealing with the question, of course, from an English point of view:

"In this country mine cars, or tubs, of about 1,000 lb. capacity are in general use, while in the anthracite

regions of Pennsylvania the capacity ranges from two to five tons, with an average of about three and a half tons. The best American cars are fitted with roller-bearings, and spring draught-gear, which reduce the heavy load at starting and the amount of draw bar pull due to friction. Another cause of the high production per man in America is the extensive use there of coal-cutting machinery. In 1913 more than half of the total amount of coal mined in America was machine-cut. Constant improvement is being made in the type and details of coal-cutting machinery, and the once popular pick or punching machine appears to be giving place to the turret or overcutting machine, and the shortwall or continuous cutter. The latest improvement is said to be a combined cutting and loading machine. Electricity is the favorite motive power in American coal mines, and it is used with less restriction than in England; notably, the use of electric trolley locomotives is permitted. Notwithstanding the vaunted thoroughness and efficiency of German methods, the average output of coal per man in Germany is only 300 tons, as compared with 760 tons in America. In this connection, Mr. Dean points to the significant fact that coal-cutting machinery is in its infancy in Germany and mine cars are ridiculously small. Considering the proverbial deliberation and caution with which radical changes are made in this country, it is highly improbable that any considerable or rapid revolution will take place in our mining methods. Changes, however, there must be, and it is wise that in making them, we avail ourselves of the experiences of other countries."

In comparing the production of coal per man employed as between the United States figures and those of Great Britain and Continental countries, however, allowance must be made for the extraordinarily favorable natural conditions under which coal is mined in the United States. In the coal regions of that country the coal seams are in many instances very thick, but slightly inclined, clean and free from dirt bands, with an analysis varying within narrow limits, favorably situated for haulage and drainage, and persistent over very large tracts of country. Nowhere, perhaps, in the world can coal be so easily and conveniently mined as in some parts of the United States. In Great Britain, on the other hand, the thickest and best seams are to a large extent exhausted, and coal is being mined from thin seams, in many instances at a great depth. Inferior seams are being also worked, scientific preparation of the coal by screening and washing being relied upon to produce a marketable fuel. What is true in this regard of Great Britain is true in a greater degree of Germany. The coal-seams of that country are notably impure, and occur in seams that are much contorted, presenting problems that would cause much worry to those who have had nothing more difficult to tackle than the problems say of the Pennsylvania coalfield. It is the "brassy" impure nature of the German coals that has forced the Germans to be pioneers in the washing and preparation of coal. It is therefore rather a misleading statement to remark, as the Times writer does, that "notwithstanding



the vaunted thoroughness and efficiency of German methods, the average output of coal per man in Germany is only 300 tons, as compared with 760 tons in America." It is also typical of the self-depreciating fad of the Englishman to infer, as the Times writer infers, that the science of coal extraction is less understood in Great Britain than in the United States. It has not yet become necessary in the United States—or in Canada, for that matter—to work thin and inferior coal-seams, such as are being so largely worked both in Great Britain and on the Continent of Europe. Such luxuries as "payment on a screened coal basis," and "blasting out of the solid," cannot be afforded in old-fashioned Europe, and the number of tons of coal produced per man employed is not always a true criterion of efficiency. The condition of the coal produced is an important consideration, and one often overlooked in the desire for tonnage records.—F. W. G.

## AVOIDABLE FIRES IN COAL MINES

The following extract from the Engineering Supplement of the London Times for October last should be of interest to practical mining men, because of its excellent common sense. The excerpt, which is headed "Plain Causes," is as follows:

"The circumstances attending the fire which occurred last month in the downcast shaft of the Exhall Colliery afford another illustration of the danger which may at any time result from obvious and easily avoidable causes. In this instance fourteen men lost their lives as a consequence of the overturning of a naked paraffin flare lamp carried by a man who was in the act of oiling some machinery in a shaft containing pitch-pine cage conductors. Although in the case of a new shaft the adoption of wooden guides is objectionable on account of their inflammability, it may be unreasonable, on the ground of cost, to require the substitution of steel guides for wooden guides in small or old collieries. At the same time, where wooden guides are in use, it seems to be obvious that extra precaution should be taken against accident by fire, and especially that the use of flare lamps in the shaft should be absolutely forbidden. Authorities, both legislative and administrative, have a peculiar faculty of neglecting the simple and favoring the recondite; and it is only by repeated lessons of a nature similar to that afforded by the Exhall disaster that they can be induced to give due consideration to plain facts. A striking illustration of this contention was to be found, until comparatively recently, in the legal attitude adopted in regard to persons employed below ground in coal mines having lucifer matches in their possession, such persons on conviction being usually let off with a fine, although the potential danger to hundreds of lives involved by such an offence is apparent to the meanest capacity. There are even now probably many simple causes of danger existing in coal mines, and if the authorities would condescend to collect, investigate, and remove them, they would not only considerably reduce the annual tale of accident and misadven-

ture, but they would also, and at the same time, clear the ground for their more abstruse researches."

It is most astonishing how the tradition of the naked light in coal mines still persists. The great bulk of all coal mine explosions and fires are traceable to the presence of a naked light. It would be a different matter if naked lights could not be avoided. A naked light coal mine to-day is an anachronism, as obsolete as the "steel mill" method of illumination, or ventilation by a furnace fire. A worse evil than the naked light mine even is the "mixed light" mine, where safety lamps are used in certain sections classed as gassy, and naked lights used in the other parts of the mine. The use of flare lamps around stables and shaft bottoms has caused fires innumerable, and yet this sort of thing persists. Elaborate laboratory experiments on the explosibility of coal-dust, and analysis of mine air, the composition of explosives and many other nice scientific problems that have come into great prominence in recent years, have led to important results and increased safety in coal mines, but all this recondite research is of little avail if the dictates of ordinary common sense are neglected. Many a man will use a naked light in a coal mine without thinking very much about it, who would hesitate to use a match or a lighted candle in his own attic. Nothing has had, or can have, so deterrent an effect on the occurrence of mine fires and explosions as the absolute abolition of naked lights underground. Without discussing the comparative merits of oil safety lamps and electric lamps, it may be stated that both oil and electric safety lamps have been brought to a state of great efficiency, and that adequate illumination is obtainable with more or less complete safety in use. There is to-day no excuse for the exposure of a naked flame in a coal mine.

The advantage of using a large volume of air in mine workings is seen in the results obtained at the Morro Velho mine of the St. John Del Rey Mining Company. In the end of a tunnel driven at a depth of over one mile below the adit level, the temperature was 105°, but, on account of the large volume of air passing, the men did not seem to be much affected. It is expected, however, that artificial cooling of the air will be resorted to.

The prosperity of the aluminum industry is indicated by the statement that production is now nearly double that of a year ago and that the Aluminum Company of America is now expending \$20,000,000 in increasing plant. This company's success has resulted largely from the utilization of cheap power.

In Canada a subsidiary company operating a plant at Shawenegan Falls, Quebec, is one of the largest producers of aluminum. The great demand for this metal continues to increase in spite of the rapid advancement of price from 20 cents to around 60 cents per pound. With so many available water powers Canada stands a good chance of becoming a still greater factor in the aluminum industry.



Comparatively few reports on oil and gas have been published by the Dominion and Provincial Governments. During the past month, however, we have received copies of two important contributions. The Bureau of Mines of Ontario has published a report by Mr. Cyril W. Knight, Assistant Provincial Geologist, on Oil and Gas in Ontario, and the Mines Branch, Ottawa, has published a second volume by Frederick G. Clapp and others, on the Petroleum and Natural Gas Resources of Canada. Those who are interested in the oil and gas industries will welcome these publications. Copies can be obtained free on application to the respective departments.

The iron and steel industry has had its share of bad times, but is now well on its way to a period of unprecedented prosperity. It is stated that the U. S. Steel Corporation is now being offered 60 tons of business for every one ton that was offered at this time last year.

Interest in the flotation process of treating ores is becoming quite general, and members of the Canadian Mining Institute are fortunate in having Mr. T. A. Rickard and Mr. E. P. Mathewson promise papers on this subject for the annual meeting in Ottawa in March, 1916.

Lieut. Neil 'Foghorn' Macdonald wants chewing tobacco for his men in the trenches. The Secretary of the Canadian Mining Institute has forwarded a supply and will be pleased to receive contributions.

#### BELGIUM'S MINERAL RESOURCES IN AFRICA.

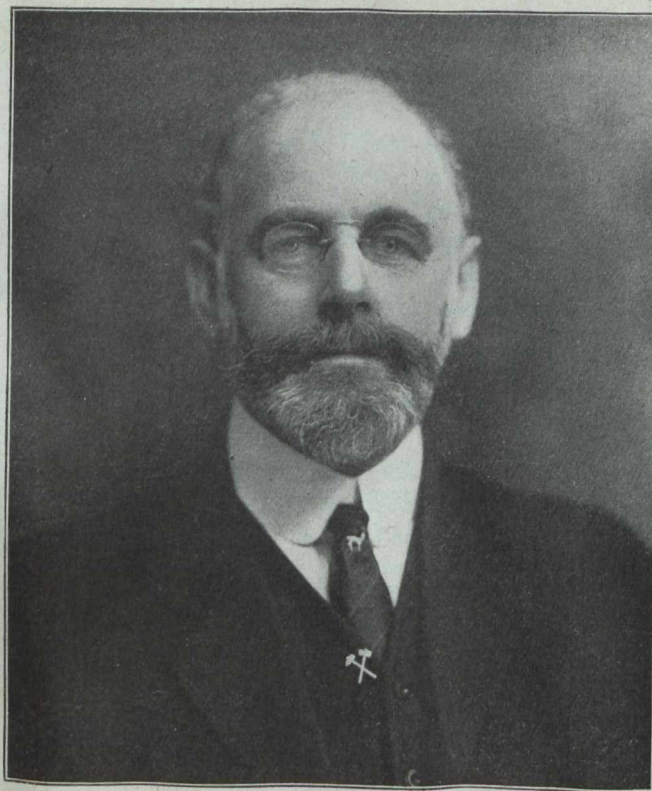
Two representatives of the Belgian Government are expected in the United States shortly for the purpose of raising a loan for that country, according to cable advices. This raises the interesting point as to what Belgium would have to offer, provided collateral were demanded.

Its Congo Free State remains as a free asset, and within the confines of that vast territory are believed to be mineral deposits of great wealth. American capital has been invested there through concessions granted by the late King Leopold, one of which went to the American Congo Co. for rubber grants, and the other to the Societe Internationale du Forestriere et Miniere for mineral and timber rights.

The rubber concession was secured through the efforts of Thomas F. Ryan and the mineral-timber rights by A. Chester Beatty, a well-known mining engineer, who obtained them through a personal visit to King Leopold at Brussels. Thus far, at least, the rubber concession has not proved profitable. Development of the mining properties has been conducted for the past nine years with favorable results.

Ownership of stock in the Societe Internationale du Forestriere et Miniere is understood to be evenly divided between the Belgian Government and a number of Americans, including T. F. Ryan, members of the Guggenheim family, A. C. Beatty and several others, Mr. Ryan being the largest stockholder.

Drilling for oil has been pushed, while metals have been sought. The concession covers about 18,000,000 acres. New York at present directs its affairs, owing to Belgium's stress.



PROFESSOR JAMES FURNAM KEMP, who has been forced, through illness, to take a prolonged rest from his duties at Columbia University.

#### CONSOLIDATED MINING AND SMELTING CO.

Shareholders of the Consolidated Mining and Smelting Company of Canada have received a circular announcing the issue of a new block and including a statement of the affairs of the company. The right of shareholders to subscribe to one new share for every five held, at par, is already known, shareholders being those on record on November 12. The right to subscribe will expire at noon, December 15.

The company has had a busy year. The circular indicates the remarkable expansion in the company's capacity for production. When plans now being carried out are complete the lead capacity will have been increased 60 per cent., and on a more economical basis. Not only is the company in a position to produce zinc commercially, but at the request of the Shell Committee at Ottawa a zinc production plant was installed at Trail to have a daily capacity of thirty-five tons of refined zinc. This involved a substantial expenditure on capital account. The zinc output for 1916, however, has been ordered by the committee at profitable prices.

The Shell Committee also requested that the company should undertake the refining of copper—a new Canadian industry. While this new departure will be carried forward on a limited scale at first, it is expected to develop and involve the treatment of much of the matte and blister copper taken from British Columbia mines. The committee have ordered at fair prices the output of refined copper during 1916.

#### ALGOMA STEEL.

The Algoma Steel Corporation, in common with the other large steel companies of Canada, is booked up months ahead. The change in the company's position since before the war is the result of the heavy demand for steel required for the manufacture of shells. All orders now on the books of the corporation are at good prices.



## METAL PRODUCTION IN ONTARIO

Returns made to the Ontario Bureau of Mines show that the production of the metalliferous mines and works of the Province for the nine months ending 30th September, 1915, was as follows. The table also shows the changes as compared with the same period of 1914.

	Value.	Increase.
Gold . . . . .	\$5,826,941	\$1,884,093
Silver . . . . .	8,030,469	*2,051,760
Copper . . . . .	2,024,658	359,762
Nickel . . . . .	5,369,536	1,345,980
Iron ore . . . . .	601,044	221,126
Pig iron . . . . .	4,510,906	*1,933,307
Cobalt ore . . . . .	12,472	14,091
Cobalt metal . . . . .	66,552	66,552
Nickel metal . . . . .	4,762	4,762
Cobalt and nickel ox- ides, etc. . . . .	124,088	*331,403

\*Decrease.

**Gold.**—The increase in the production of gold amounts to one-third. The gold districts of Northern Ontario are fulfilling the prediction made several years ago that they would make good the loss caused by the waning of the silver mines of Cobalt. Thus the combined value of the gold and silver output of the first nine months of the present year was only \$167,661 less than for the same period of 1914, notwithstanding the fact that the yield of silver fell off over 20 per cent. Part of this decrease is due to the low prices which prevailed during the whole nine months, but which made a sharp and decided recovery in November. In gold the Porcupine mines make an excellent showing, practically every mine on the list having increased its output. Hollinger continues to lead, being now coupled up with Acme, whose ore is crushed under the same roof. The new producers are Dome Lake in the Porcupine camp, and Dominion Reduction Company, from the latter's spectacular free gold property in Munro township.

**Silver.**—Nipissing heads the list of silver mines at Cobalt, with Mining Corporation of Canada, Coniagas, Kerr Lake, Seneca Superior and Temiskaming following in the order named. Silver to the extent of 50,527 ounces was recovered from the bullion of the gold mines.

**Nickel.**—The Sudbury mines are being worked to the maximum capacity, and the production of nickel for the nine months nearly equals the largest previous output for a full year. Over 75 per cent. of the output is made by the Canadian Copper Company, but the operations of the Mond Company are now more extensive than formerly, and its output has correspondingly increased.

**Copper.**—The yield of copper was also much greater than in the corresponding period of 1914, and nearly equaled the total output of that year. It was all contained in the Sudbury mattes, which are sent to Bayonne, N.J., and Clydach, Wales, for final treatment.

**Iron.**—The shipments of ore show an increase, the output coming from Magpie, Helen and Moose Mountain. Stock piles were drawn upon at the two latter, and a limited quantity of briquettes were marketed by Moose Mountain. The output of pig iron suffered a decrease of 28 per cent. in quantity and a slight lowering in the average selling price per ton.

**Cobalt and Nickel Metal.**—Metallic nickel and cobalt are now produced from the silver ores of Cobalt by the smelters at Deloro and Thorold. Of the former 98,216 pounds and of the latter 24,962 pounds were made and shipped during the nine months. The trade in cobalt and nickel oxides has been heavily affected by the war, and the quantities shipped were much below those of the corresponding period of 1914.

**Molybdenite.**—Efforts are being made to produce molybdenite, which is in demand in England for the manufacture of steel for ordnance-working tools. The British Government has requisitioned all supplies of this mineral arriving in Britain at the rate of 105 shillings per unit delivered, on the basis of 90 per cent. concentrates. Molybdenite occurs in pockets in many parts of Eastern Ontario, and there should not be much difficulty in obtaining a considerable supply to help meet the needs of the English steel makers.

### INTERNATIONAL NICKEL CO.

For the first seven months of the current fiscal year, profits of International Nickel Co. were about \$1,000,000 ahead of entire preceding fiscal year. Profits are running not far from \$1,000,000 a month, and with five months remaining to complete the fiscal year, profits will be approximately \$6,000,000 ahead of last year.

The company has in the treasury between \$7,000,000 and \$8,000,000 cash, besides \$1,000,000 of the Anglo-French loan paid for. A considerable increase of treasury cash over present amount is certain by close of the fiscal year March 31st.

Prospects for extra dividends in March are more than promising. The company, being a mining and smelting concern doing a strictly cash business, does not require large working capital.

Plan to split the common stock into shares of \$25 par is being well received. Investors argue that desirability of a stock depends on security of investment, remunerative dividends, and, not least, availability as an asset and use as collateral. In case of \$100 shares selling at 200, availability was lacking, as the stock had become entirely an investment issue in which often one had to sacrifice several points to sell a few hundred shares; the same applied to the buyer in opposite direction.

The company is now paying 5 per cent. quarterly. It recently paid a 10 per cent. stock bonus which, with the stock at 200, is equal to 20 per cent. Even if shareholders do not receive any further extra dividends in the present fiscal year, it will still have paid 40 per cent. for 12 months.

A smaller percentage of output is now consumed in manufacture of munitions than before the war, despite the fact that sales of nickel have largely increased.

The enormous increase in production of automobiles is an important item in consumption of nickel. It is used to strengthen the steel in frame of the car, but especially in toughening moving parts of the machine; the latter are frequently 30 per cent. nickel.

While renewing from time to time its old contracts, International Nickel Co. has made no advances in price to either contract or retail trade. Ruling prices for nickel are barely half those prevailing at formation of the company. Its aim is to encourage consumption of nickel by expanding variety of its uses, whereas an advance would tend to discourage its employment.

The big advance in price of copper has greatly benefited the company's earnings, as it turns out as a by-product about 3,000,000 pounds of copper a month.—Boston News Bureau.



## THE PRODUCTION AND USES OF RADIUM

U. S. Secretary of the Interior Lane has through the U. S. Bureau of Mines made public the methods whereby the Bureau has been able to produce radium for less than one-third its present selling price. The cost of radium at the Denver Experiment Station of the Bureau, including the higher cost of the first experimental work was \$37,000 for each gram of radium metal. The market price of radium for the last two or three years, according to the Bureau of Mines, has been from \$120,000 to \$160,000 per gram.

"The result of the ability of the Bureau of Mines to produce radium for \$37,000 a gram," said Secretary Lane, "has at least made it possible for two great hospitals in the country to obtain a goodly supply of radium for use in the treatment of cancer, that dreadful disease that is costing the lives of 75,000 human beings every year in the United States. Up to the present time, five grams of radium have been extracted from the carnotite ores and about half of it has been delivered in finished form to the Kelly Sanitarium in Baltimore and to the Memorial Hospital in New York.

"The Bureau of Mines produced this radium in cooperation with what is known as the National Radium Institute, which was organized for the purpose of studying the curative properties of radium and not for private gain. These investigations have from the first been under the direction of Dr. C. J. Parsons of the Bureau of Mines, the funds being furnished under cooperative agreement between the National Radium Institute and the Bureau of Mines by Dr. Howard A. Kelly, of Baltimore, and Dr. James Douglas, of New York.

"The application of radium in the treatment of cancer and other malignant growths has made much more rapid progress in the last two years than is generally appreciated even by the medical profession. All kinds of opinions may be easily had from the laity and from cancer experts, and the public can draw almost any conclusion from the statements appearing in the newspapers, but preference should be given to the opinions of those persons who have had extended experience in the use of radium in sufficient quantities to enable them to speak authoritatively.

"One thing regarding radium therapy that has been developed is that if the gamma rays of radium are to be successfully applied to the cure of cancer, a much larger quantity of radium must be used than is possessed by not more than two or three individual surgeons or hospitals in the United States. I know of no individual or hospital that has had the privilege of working with so much as half a gram of radium that does not report cures in increasing number or that is not able to treat even advanced cases with increasing success as a knowledge of technique is developed. The extent and variety of cures reported and the helpful effects of the gamma rays at depth are almost in direct proportion to the quantity of radium that can be applied at one time to the patient. I do not mean that radium in comparatively small amounts may not be effective with some forms of cancer or some malignant growths in their incipiency, but in two American hospitals that have a half a gram of radium or more, results are being obtained daily that unquestionably will not be duplicated elsewhere until equal quantities are available. Physicians and surgeons who do not have this much radium have no right to criticize or condemn

the physicians who have more and who are obtaining results.

"At the time the bureau began its radium investigations, the miners and prospectors in Colorado and Utah, who were engaged in the mining of carnotite ore, were receiving between \$75 and \$80 a ton for their ore, this price being for the ore delivered in New York, for shipment to Europe. The ore was being sent abroad in quantity and was not being treated in this country, although one or two companies were rapidly purchasing from prospectors claims at \$50 to \$200 and thereby laying the foundation of a future possible monopoly in this rare material. It was hoped that methods could be found that would enable miners and associations of miners to extract the radium from their own ores, place it on the market, and obtain profits that had been going to foreign manufacturers. By August, 1914, when the European war came on, carnotite ore was selling for more than twice the price that had been obtained in the summer of 1912, this being undoubtedly due to the Bureau of Mines calling attention to the situation as it existed at the beginning.

"At this time, there were sixteen to twenty grams of radium contracted for abroad, chiefly in Germany, at prices above \$120,000 a gram. Seemingly the war has not affected the market price but simply the amount produced.

"As to the selling price of radium in the future, the Bureau of Mines makes no prediction, but it does not follow that the selling price will decline because of the cheaper methods of production. The situation is somewhat analogous to the production of gold, diamonds or any other material that is in steady demand but occurs only in small quantities. Beyond doubt, the amount of radium in nature is exceedingly small. Other deposits of radium ore may be found, but it is highly improbable that the past rarity of radium ores will be greatly modified, so that the price of the radium will largely depend on the ability to procure the raw material.

"According to the best evidence that the Bureau of Mines can obtain, there is not sufficient ore available to maintain for many more years the rate of production in 1914.

"When this radium work was taken up, it was the desire of the department to show beyond doubt that, if authorized by Congress, the radium could be procured from ores then owned by the people at a cost approximating one-third the market price, and that it was much better policy for the Government to obtain the radium so greatly needed in the hospitals of the army, navy, and Public Health Service at this low cost than to give these ores to large corporations and then purchase as radium material that had belonged to the people, at a price insuring large profits to the possessors. Unfortunately, the bill introduced into Congress in 1914, which would have accomplished this purpose, failed to pass and in the meantime the carnotite areas have been thoroughly prospected and the most valuable claims located. Accordingly we must be content with the good that may come to the American people through the radium being extracted in the plant of the National Radium Institute until such time as the Government may furnish funds sufficient to enable it to purchase in the open market such ore as may be necessary to supplement the little that remains unlocated on Government land.

"The report of the bureau on this new and cheaper method of producing radium from carnotite ores is highly technical in its character and will only interest



those chemists who are engaged on such work. The methods devised are entirely new and differ from former methods not only in detail but in apparatus used. The time of operation is much shorter than in any other plant now producing radium and the commercial recovery is much greater. Furthermore, it is believed that the cost of production is less than that in any method used heretofore. It should be remembered, however, that the methods apply solely to the treatment of carnotite ore and are not necessarily applicable to pitchblende or autunite. The methods of extracting the radium that have been evolved may be utilized under intelligent technical control by any firm, association, or corporation that can obtain the raw material. Although being patented for the benefit of the people, the processes may be used freely by anyone within the United States."

### BEAVER CONSOLIDATED.

Under date of Dec. 8, 1915, President F. L. Culver in a letter to the shareholders of Beaver Consolidated Mines, Limited, says in part:

"During the quarter ending Nov. 30 we have been pursuing our policy of aggressive development. The main shaft has now reached a depth of 1,235 ft. The station is being cut at the 1,200-ft. level and when completed, sinking will be resumed, as we wish to reach the lower contact between the diabase and Keewatin formations as quickly as possible. Diamond drilling has proven that this contact exists between 1,600 and 1,700 ft. from the surface. It is believed that we will obtain values along this lower contact as we did on the contact between the 460 and 530 ft. levels. You can readily estimate the value of such a discovery. When we opened up the 200, 250, 300, 350 and 400 ft. levels, we had no concentrating mill on the property and consequently were looking for high-grade ore only. Very little work has been done on these levels since that time, but we have recently placed drills back on the 200-ft. level and will explore these levels thoroughly for mill rock and possible high-grade. So far the results have been very good. The addition to the mill has been completed and it is now treating from 125 to 150 tons daily.

"We presume you are familiar with the phenomenal gold discoveries which have been made north of Cobalt and the large gold mines which are now operating in that district. The directors have been making investigations for some time in the hope of obtaining a property with sufficient showings to warrant them in making an offer so as to attach a gold property to your already large holdings, and recently have taken an option on the stock of the Kirkland Lake Gold Mines, Limited. This company owns 365 acres of land in the Kirkland Lake District, in the Township of Teck. One of the claims, known as the McKane Lot, touches the Teck-Hughes, which property is now being operated by the Buffalo Mines Limited of Cobalt, who are building a large mill for treating the ore which they have in sight. The Lake Shore Mining company, which has some excellent showings, is operating a short distance from the Kirkland Lake property. The Tough-Oakes mine, which is now producing about \$80,000 a month and is fast developing into one of the big mines of the North Country, is a little over a mile away. This company has recently entered the dividend-paying class and will pay its second dividend on January 3, 1916. These properties are all in the same mineralized zone. On the McKane lot of the Kirkland Lake property is a fully equipped plant consisting of two boilers, a small com-

pressor and sufficient mine buildings. A vein has been discovered on this lot and proven for a distance of 1,400 feet. A shaft has been sunk on this vein to a depth of 79 feet, from which our engineer has obtained assay values as follows: \$262, \$156, \$182, \$46, \$48, \$120, \$131 and \$180. Our agreement with the Kirkland Lake Gold Mines Limited provides that we are to expend at least \$2,000 a month on development for the next year. At the end of that time we will be in a better position to determine whether or not it will be advisable to take over the company and its assets. In the meantime, all of the stock of the company is being held in escrow, but as our development progresses, it is arranged that we will receive stock from month to month for our expenditures. At the end of the year, if the development proves satisfactory, we can then exercise our option by taking up the balance of the stock at prices which we deem to be very attractive.

November 30, 1915: Bullion in storage, 57,296.18 oz.; ore at smelters and in transit, 126,779 oz.; ore bagged at mine, 35,940 oz.; total, 220,015.18 oz.; cash on hand, \$122,674.24.

"On October 15th we paid a dividend of 3%, distributing \$60,000 among the shareholders. The price of silver has advanced considerably during the quarter, the quotation on November 30th being 56 $\frac{3}{8}$ c. an ounce as against 46 $\frac{1}{4}$ c. on September 1st."

### IMPROVEMENTS AT TRAIL SMELTER.

At Trail, the smelting centre for Kootenay ores, important progress is manifest. Of course the greatest activity is at the Consolidated Co.'s smelting and refining works, where many improvements and additions have been made during several recent years. In fact, there has been an almost entire transformation of the ore-reduction side of the works, old buildings and plant having been gradually replaced by larger modern structures and equipment, thus providing for a considerably increased ore-treatment capacity and this at reduced cost. These comments apply to both lead and copper-smelting departments. Larger storage bins for ores with ample provision for bedding so as to secure generally uniform charges for the blast furnaces, enlarged and improved sample mills, better transportation arrangements between ore beds and furnaces, bigger blast furnaces for both copper and lead, an overhead electrically-operated crane for handling matte pots, the substitution of Wedge roasters for the old Huntington-Heberlein roasters long in use in the lead department, belt-conveyors for handling materials in and from the roasters, several treaters of the Cottrell system for precipitating metals carried from the furnaces in the fumes and smoke, and many other provisions for more expeditious and economical treatment of ores and furnace products and, as well, for improving working conditions for the men employed in the smeltery. Methods at the company's electrolytic lead refinery are also up to date. Excellent progress has been made toward the completion of installation of copper-converting plant and it is generally understood (though not so stated by the local officials) that it will not be long before copper refining by the electrolytic process will be undertaken here. Meanwhile the buildings and machinery for zinc reduction works being erected and installed by the company are an earnest of the intentions to also make spelter at Trail, though no information is being given out relative to this further extension of the company's activities.



## THE VALUATION OF METAL MINES\*

By T. A. Rickard.

The present value of a mine is based on an estimate of future profits. The profits are expressed in terms of money. The value of money differs with time and place. While money is unlikely to differ in value notably in the same place during the relatively short life of a mine, it is likely to be affected by the condition of locality. Money is worth less at New York than at Tonopah, for example, the prevailing rate of interest in the one case being 4 or 5 per cent., and in the other from 8 to 12 per cent. per annum. This difference tends to facilitate the transfer of a mine from an owner in the desert to a capitalist in the city. The latter is content with a smaller return on his "investment," as he is apt to call it. The difference in the point of view tends to promote business.

In all business transactions the point of view is vital; hence the difference between the valuation of mines for purchase and the appraisal of them for taxation. Attempts have been made to put both kinds of estimation on the same basis. They have failed. The purchaser buys a mine to hold it and to exploit it until it is exhausted; when the purchase is completed, he cannot revise the transaction. If he buys with the idea of re-selling, he must do so on the supposition that the next buyer will act intelligently; that is, as a sensible man, the purchaser cannot assume an escape from a blunder by the interposition of somebody more foolish than himself. Such assumptions, it is true, are not uncommon, but they proceed on lines of reasoning outside the limits of an economic investigation. Therefore, I repeat, the purchaser whether an individual or a company, buys with a view to exploitation. The State, on the other hand, assesses the mining property annually, and is in a position to remedy any error in its estimate from year to year. The first appraisal is not irremediable; therefore it is not so momentous. Nevertheless the State authorities, recognizing the inherent difficulties of the problem and their incapacity to solve them, usually avoid them by simply taxing the output of the preceding year, that is, they prefer to deal with the statistics of actual production. They appear to recognize, or they may have merely surmised, that the ante-mortem diagnosis of a mine is necessarily aberrant. In truth, it is a tricky business. Having regard to the inherent difficulty of estimating future production, it is not surprising that the taxation of output has been adopted in most States as the most practicable method. It seems best for the purposes of annual taxation, even though it may fail to penalize those owners who choose to leave their properties idle in the hope of selling them at a higher price or of exploiting them when the market for their product is more favorable. This evasion can be checked, to some extent, by taxing the claim-area or acreage, whether productive or not, to such a degree as to render long idleness prohibitive.

**The appraisal of mining properties for State taxation** has had the good effect of drawing public attention to a subject heretofore deemed too recondite for general discussion. Mining engineers, among themselves and in the technical press, have touched upon the problems involved, but, on the whole, the solution of these problems has been deemed in the nature of a professional

secret, to be left in the safekeeping of the individual. The active members of the profession, or practitioners, it may be inferred, consider it impolitic to publish the particular basis on which any one of them might see fit to value a mine for his client. If an engineer were to state beforehand that he could not report favorably unless certain fixed conditions were fulfilled, he might cause sundry vendors to object to having their property subjected to a test so exacting as to render business impracticable, with the further unpleasant consequence of placing a black mark against the name of the mine. Moreover, the criteria to be used in valuing different mines by the same engineer would vary in accordance with the character of the mining and of the client. In some kinds of mining the uncertainties are vastly greater than in others; so also some clients are willing, and can afford, to take bigger risks than others. For reasons of this kind the scheme of valuation is rarely set down in black and white, not even for professional information, much less for public enlightenment.

Within recent years, however, the State of Michigan engaged a mining engineer of acknowledged repute, Mr. J. R. Finlay, to make an appraisal of its mining properties for purposes of taxation. Other state commissioners had tried to perform the same task under the guidance of politicians, labor leaders, geologists and various gentlemen distinguished by varying lack of fitness for the task. In this respect they were like the lay public, which is learning slowly and painfully that the only person likely to value a mine successfully is a mining engineer equipped with the requisite training and experience. It is fair to add, however, that the State of Wisconsin deputed the study of mine valuation and assessment in its zinc-producing territory to a member of its Geological Survey, namely, Mr. W. L. Uglow, whose report gives the impression that he also, although probably less versed in the management of mines, has envisaged the subject with convincing skill.

The official reports<sup>†</sup> issued as a sequel to the investigations made by Messrs. Finlay and Uglow furnish an excellent text for a general discussion of the subject. Mr. Finlay states that his appraisal is "a calculation of the value of mines to the permanent owner for the production of minerals." The value of a mine for share-market purposes is ignored; so is its value for the purpose of re-sale. Neither aspect of the problem came within his province. The calculation is based on three factors:

1. The average cost of production.
2. The average price obtained for the product.
3. The future life of the mine.

The first two are determined "by experience," that is, they can be ascertained by investigating the records of the mine and of the industry, with sagacious inferences therefrom. The third factor is "based partly on developed ore and partly upon an assumption of continuance of known orebodies beyond the present bottom levels of the mines."

From these three factors the future net profits, or dividends, are calculated. The present value of such dividends is then reduced by the annuity method to a sum upon which they will pay a given interest and at

\*A paper presented at a meeting of the International Engineering Congress, 1915, in San Francisco, Cal., Sept. 20-25, 1915.  
<sup>†</sup>"Appraisal of Mining Properties of Michigan," by the State Board of Tax Commissioners, 1911. "A Study of Methods of Mine Valuation and Assessment" Wisconsin Geological and Natural History Survey, 1914.



the same time provide an annual contribution into a sinking fund, which, re-invested, and added to prior installments similarly invested and re-invested, will redeem that sum within the period covered by the life of the mine. Mr. Finlay took 5% as the dividend interest and 4% as the rate of amortization. This may be accepted as adequate for the particular, and relatively safe, type of mining illustrated by the copper and iron deposits of Michigan, but in precious-metal mining, which is more hazardous, the rate of dividend should be at least 10%, with the possible exception of a few orebodies of extraordinary uniformity.

This method, of course, ignores unprofitable mines. It is also inapplicable to prospects. On the other hand, the mere discovery of mineral on land may give it an immediate and taxable value, to be determined on a different basis, as is shown in Mr. Finlay's report. In the productive copper mines he had a relatively simple problem. For instance, in the case of the Wolverine, the records showed that during the preceding five years the necessary data were as follows:

Yield of copper per ton of ore, 26.7 lb.; cost of producing copper per pound, 7.65c.; average price of copper per pound, 15.60c.; profit during the five years, \$3,896,270; estimated total future production of copper in pounds, 80,000,000; valuation of the mine, \$3,700,000.

The Wolverine orebody represents an enriched portion of the Kearsarge lode, which consists of a layer of amygdaloidal diabase impregnated with native copper. The lode has a fairly regular dip of 40 deg. and has been traced on its strike for five miles through a series of most productive mines. Mr. Finlay assumed, or "calculated with certainty," that part of the Kearsarge lode will continue profitable to at least 6,000 ft. in depth and that 60% of the lode-area within the known profitable length will be mined to that great depth, yielding an average of 16 lb. copper per ton. On this basis the lode would yield 70,000,000 tons of ore, in addition to the 20,000,000 already mined. And of the grand total he credits the Wolverine with 3,600,000 tons. He gets at this by taking the surface area covering the lode on its dip at 215 acres, and the thickness of ore at 12 ft.—for the stoping-width is remarkably regular. Estimating that the reserve of ore will last for nine years, that the copper can be won at 8 cents per pound, leaving a profit (on a 14c. price) of 6 cents per pound, he obtains a total profit of \$4,800,000 and a present value of \$3,700,000.

In appraising the copper mines of Michigan, Mr. Finlay had no trouble in obtaining accurate data in regard to cost, for the books of the companies operating the mines were open to him. These companies are old and respectable; the technical management is first-class; any information required by an accredited investigator is given willingly and accurately. Mr. Finlay could have had no trouble in ascertaining the total cost per pound of copper. Then he had to make an estimate of the probable price of copper during the future life of the mines under appraisal. He decided that 14 cents would be fair, although personally inclining to believe that this was low. That was in August, 1911. Since then the price of Lake copper has been as follows:

Year	Average
1911 .....	12.63
1912 .....	16.56
1913 .....	15.70
1914 .....	13.61

His estimate needs no apology. He was making an

appraisal for annual taxation; presumably therefore the valuations of the various mines could be reviewed from year to year and corrected in accordance with the rise or fall in the price of copper. If he had been valuing the mines for a purchaser, he would, by taking 14 cents as an average price, have been no more conservative than we should reasonably expect an engineer to be under such circumstances. In short, he is justified in the result.

As regards the life of the mines, Mr. Finlay could make no personal examination in the time at his disposal; he had to examine the records, with maps and sections, assisted by the willing information of the managers. On this he could rely to a degree not usual in the examination of mines in private practice. The copper mines in Michigan are well developed, the character of the orebodies is well understood, the relative persistence of the ore has been ascertained. Indeed, the non-persistence beyond a known horizon helps the appraiser, who is not called upon, as in some regions, to give serious thought to dreams of unlimited continuity in depth. The length of ore likely to be extracted is, in most cases, determined either by the boundaries of adjoining properties or by exploratory work, for the intelligent mine-operator endeavors to ascertain these fundamental facts as soon as possible, in order to plan intelligently and to equip providently. Therefore I conclude that Mr. Finlay's estimates of "life" were so correct as to afford a safe basis for the appraisal required by the Tax Commission.

Turning to the similar effort at scientific valuation in Wisconsin, two years later, it will be found that Mr. W. L. Uglow was instructed by law to assess mineral land at the "full cash value" it would bring "at private sale." This was understood to mean "a sum of money which engineers and business men would be willing to pay for a property if they should have full knowledge of all the facts of past production and future prospects at their command." The lack of "full knowledge" in regard to future production is, of course, the crux of the whole matter; indeed, it is the one awkward factor, and for that reason it is usually pushed into an obscure background.

Conditions in Wisconsin are relatively simple. The owners of the land are mostly farmers, who lease the ore-bearing areas to mining companies. The latter test the ground by churn-drilling and then sink their shafts, preparatory to extracting the ore, which lies at a shallow depth, the maximum being about 250 feet below the surface. A royalty of about 10% on the gross output is paid to the owner as his rent or share of the earnings. He pays the real-property tax, as well as an income-tax on his rent. The ore-bodies have their greatest dimension horizontally; about 10% of the crude ore is left as pillars; the ore consists of blende, galena, and pyrite disseminated in limestone; it is subjected to concentration, the concentrate being sold to the smelting companies. The properties are small, for the shallowness of the deposits does not compel concerted effort or big capital expenditure.

In order to get at a reasonable basis for valuing the zinc mines of Wisconsin, Mr. Uglow takes a "hypothetical zinc mine," built upon the figures obtained from eight properties; these figures in turn he reduces to weighted averages over a period of four years. This four-year life is assumed on the basis of local experience. Of course, a whole lot of other assumptions have to be made, such as the price of spelter, which is put down as 5.7, 5.4, 5.0, and 5.5 cents per pound for the four years respectively, although it is not clear why the



guess should not be made uniform. Apart from the fact that the price of zinc is beyond the vaticination of any appraiser of mines, it is noteworthy that in the last stage of his valuation Mr. Uglow deducts 15% "on account of the absence of data for checking the assumed figures for grades of ore." If 15%, why not 51%?

Having constructed this hypothetical mine, Mr. Uglow applies it to ground "well drilled" and ground "poorly drilled at the outset." The present value in the one case is \$168,117 and in the other \$125,180 at the beginning of the first year.

Next he applies various systems of valuation to this hypothetical mine and arrives at the conclusion that the most suitable method for the zinc mines of Wisconsin is that of equated income. To ascertain the value of a mine, therefore, he multiplies the annual operating profit by 2.43, this latter factor having been determined by mathematical analyses on the assumption of equal annual profits and an average life of 4 years. He concludes that, as compared with the ad valorem method, this scheme has the advantage of being based on the estimated average life of all the mines, not a particular one, in the district; it is calculated on the actual profit of the preceding year, not upon an estimate of future profit; moreover, it is well adapted to taxation because it assesses a mine in accordance with its ability to pay, rather than its sale-value.

Again we face the fact that the valuation of a mine for purchase and its assessment for taxation constitute two different problems. The tax-gatherer's valuation is made annually, and can be revised annually, therefore it is convenient to base it upon the actual profit—not production—of the previous year. The future does not concern the tax-gatherer; he takes short views of life; it is his duty annually to collect a contribution to the revenue of the State in equitable proportion.

We shall leave him to his troubles, which are relatively small, for it is our purpose to discuss the valuation of mines for sale or purchase, which is a far more difficult problem.

**Valuation for Sale or Purchase.**—In order to value a mine, that is, to determine the price at which it is a reasonable purchase, it is necessary to estimate its future profits. That is done in successive steps, ascertaining:

1. The average yield per ton of ore
2. The average cost per ton of ore.  
(The difference between 1 and 2 is the "profit")
3. The tonnage available now.
4. The tonnage likely to be available in future years.

Each step demands skill and experience. The yield is determined by a careful sampling of the ore exposed in the workings, by comparison with past records, and by an estimation of the probable extraction in the mill or smelter. The metal contents as determined by assay do not represent the yield; to ascertain that it is necessary to know the percentage of extraction by the metallurgical method most suitable. Mines are bought sometimes on the expectation of applying increased skill to the extraction of the metals from the ore. The expectation may prove too flattering.

The average cost can be ascertained from past records, with corrections based upon any anticipated change of conditions. The anticipations may prove fallacious. The records may be deceptive. "Cost" is interpreted variously. Among British-owned mines, particularly in Rhodesia and West Africa, it is customary to give a figure for "cost" that omits many inevitable items of expense, such as head-office expenses,

taxes, insurance, depreciation, improvements, recruiting for labor, even development and prospecting. In some cases the omissions represent discrepancies of 30% to 40% from the actual cost, giving phantoms profits highly useful for share-market purposes. The big mines of the Rand issue monthly figures of profits that are illusory because in the cost the Transvaal profit-tax is omitted, together with London expenses, income tax, debenture interest, and additional expenditure on new equipment. The result is that the profits periodically announced are 30% more than the dividends. I have always argued that the profit to the shareholders, who are the owners of a mine as conducted on the joint-stock principle, is represented by the dividends that actually get into their pockets or are lodged to their bank-accounts. To many persons some of the items, such as interest and taxes, seem beside the mark. The borrowing of money on debentures, however, usually represents a miscalculation in the original estimate of initial expenditure for development and equipment. As for income-tax, it may be said that it is only a matter of book-keeping, since the collection at the source obviates later payment by the shareholder. But the income-tax on a mine is a true (and most inequitable) item of cost, for in most cases it is a tax not on income but on the return of capital. Until a mine has redeemed its purchase price, its dividends are not income. A mine is a wasting asset.

**"Overhead" Expenses.**—Many blunders in valuation are made by engineers owing to lack of knowledge concerning the "overhead" expenses. Any sagacious appraiser of a mine that is to be placed on the London market, and to be managed from there, should add 10 to 20%, according to tonnage of production, to his operating or local cost, if he expects to make a forecast that will stand the test of future accomplishment. Indeed, the best school for the appraiser is last year's almanac; let him read the old reports and valuations of mines now approaching exhaustion. He will see how errors were made and how estimates were falsified. For example, the small additions to equipment made from year to year may seem a minor item. No allowance usually is made for re-building or replacing the existing reduction works, yet no mill or smelter remains intact for many years, if the owners are progressive. Fires and other accidents will happen. Decay and destruction, wear and tear, are inseparable from machinery and equipment. For example, the cost of new equipment at the Bunker Hill & Sullivan mine, in Idaho, averaged 80 cents per ton during 22 years, on a total operating cost of \$2.66 per ton. Again, when I examined the Camp Bird mine in 1900 I found that Thomas F. Walsh, the owner, had extracted \$2,535,000 worth of ore at a cost of \$6.50 per ton. I estimated the ore assured at \$6,000,000 and anticipated that the cost could be reduced to \$5.25, in consequence of an improved equipment and larger tonnage of production. The mine more than fulfilled the expectations of productivity and profit, but the average cost was \$10 per ton. The administration and general expenses of a London company proved more costly than I had anticipated, in comparison with the thrifty management of an individual owner. The reading of old reports shows that a post-mortem will give data more reliable than those obtainable from a diagnosis made while the patient is alive; unfortunately, old reports disappear, to the comfort of the profession, and exhausted mines cease to be interesting except to the historian; therefore this source of guidance is not readily available to the student of the subject under discussion.



**Tonnage.**—The ore exposed can be measured and an estimate of that which is partly exposed can be made with reasonable accuracy by an experienced engineer, that is, by one wise to the vagaries of various types of ore deposit. When, however, the next step is taken, namely, the estimation of ore likely to be rendered available in future years, as the result of intelligent development and exploration, the engineer faces a crucial problem and one that may render all his previous ratiocinations utterly futile. The test of science is prediction; the inability of the mining engineer to predict the continuity of an orebody suggests that the appraisal of mines is not a science, but an approximation based upon empiricism.

Attempts have been made to express the probabilities of ore-persistence by formulae. Some engineers allow for future prospects by adding a fixed proportion—from 20 to 35%, for example—to the ore already proved. Such short cuts are illogical. They constitute a mere surmise. Mr. H. C. Hoover has suggested that “the minimum extension of an orebody or ore-shoot in depth below any horizon would be a distance represented by a radius equal to one-half its length.” This may apply to his special experience in Western Australia, but it is dangerous doctrine, for, as he himself adds: “This is not proposed as a formula giving the total amount of extension in depth, but as a sort of yardstick which has experience behind it.” Another writer, with less experience and therefore greater positiveness, has offered sundry elaborate formulae for the purpose of expressing the probabilities of ore-extension in depth. These, apart from their academic interest, are interesting as indicating how many uncertain factors are involved in the calculation. They are useful as suggesting a line of reasoning, based upon the length and thickness of the ore-shoot, the number of levels already proved, and the patchiness of the lode within the ore-shoot. Indeed the methods of an actuary may be illuminating to an engineer, but the latter must realize that human life has been studied much longer than the distribution of ore underground, and that the eccentricities of human nature are better understood than the vagaries of ore deposition. Calculations based on a large number of guesses can only yield a guess. The doctrine of probabilities has been stultified in mining too often to allow of its being stated as a scientific thesis.

Having ascertained the tonnage of ore in the mine and the probable profit per ton, the engineer can say that the ore assured will yield so much money, while the ore likely to be uncovered will enable so much more money to be taken out of the mine in future years. How much then is the property worth?

While the estimation of ore in most mines is hazardous, especially in the case of rich precious-metal veins or lodes, it is a pleasant fact that in certain types of deposit the size and continuity of the orebodies are such as to minimize the variation of metal-contents to the point of relative uniformity of production over long periods. This is true, or has been true for many years consecutively, of the native-copper lodes of Michigan, the gold-banket of the Witwatersrand, the gold-bearing schist of the Homestake, the copper-pyrite lenses of Huelva, and the extensive chalcocite impregnations of Nevada, Utah, and Arizona. However, even in these cases, it must be confessed that, for purposes of appraisal, the knowledge now available has come at a late date; it has come in the wake of experience, not as the result of preliminary investigation. Moreover, it is not applicable to other mines in other regions,

save at great risk. Most young mines—and it is young mines we must appraise, as it is young people that we must insure—cannot be judged on the basis of experience on the Rand or in Michigan. That is why engineers with local experience in particular districts so often fail in diagnosing mines in other districts.

We return to the question: what is a mine worth, given an estimate of future profits? We have seen Mr. Pinlay's formula, based on 5% for interest and 4% for amortization. I have said that his return of 5% might do in the case of the copper and iron mines of Michigan, but it was too low for most mining enterprises. Mr. Hoover says that “the mining business is one where 7% above provision for capital return is an absolute minimum demanded by the risks inherent in mines, even where the profit in sight gives warranty of the return of capital.” With this, of course, I agree. Indeed, in most precious-metal mines 10% is not too much. On the other hand no figure can be stated as generally applicable. It depends upon the factor of risk, which varies in each case, not only as regards the continuity of the ore, but the capacity and honesty of the management. This feature of the problem has been well elucidated by Mr. Burnham, who asks, and answers, the question as to how much a mine ought to pay over the standard rate of interest on gilt-edged stock. Besides the addition to cover “the yearly contribution for capital redemption,” he insists that provision be made for “the risk of loss of either capital or interest.” Thus by the time the engineer has made his estimate of the value of ore assured and the profit therefrom, he finds his figures blown into the air by this explosion from under his very feet. These final considerations regarding the rate of return on the purchase price of the mine afford divergences so big that all the little refinements of measuring, sampling, and assaying are rendered pitifully inconsequent. If we take the standard rate of interest on national bonds as 3% and if we add to this another 4% for capital redemption, we are brought face to face with the decision as to what further percentage must be made to provide for the risk inherent in mining and the final risk involved in a particular mine. Suppose we agree on the third item of our enquiry and call it 3%, even then we have the fourth item to ascertain—and it is by far the most momentous in the whole of our enquiry. It may range from 0 to 100%.

Let me illustrate. Many years ago I examined a small silver mine in Boulder County, Colorado. The vein was narrow but rich. The ore-bearing ground was sampled thoroughly. The result was to show that \$150,000 worth of ore could be extracted at a cost of \$40,000, working through an existing adit, so that \$110,000 could be earned. The owners were willing to sell for that sum, half cash and half in six months. The winzes below the bottom level or adit showed that the vein was poor and broken by faults. The prospects in depth seemed to me slim. I considered it a poor purchase, because the risk of the known ore yielding less than the amount estimated outweighed the probability of finding more ore in virgin ground. Even 100% per annum—that is, the return of the purchase price in one year, as was feasible in this case—was not good enough. The later story of the mine justified this decision.

In a recognized guide to these matters, namely, the “Report Book for Mining Engineers” by A. G. Charleston, an example of mine valuation is given. In this hypothetical case the property contains 704,000 tons of ore averaging \$12 in gold per ton, making \$8,448,-



000. Allowing for a recovery of \$10 and a cost of \$7.50 per ton, the profit comes to \$2,464,000. The conditions specified are: (1) That the above profit is to be won over a period of 11 years, (2) the plant and equipment are to cost \$183,700, and to this is to be added compound interest for two years at 5% during the time of development precedent to profitable production, (3) the capital is to be redeemed at 2½%, and (4) the purchaser is to be allowed 20% on his money. Therefore the present value is \$290,000. As if this were not drastic enough, Mr. Charleton shows that on a 40% return the present value would be \$4.00. This *reductio ad absurdum* shows where these methods of valuation land. After taking great pains to sample the ore and equal trouble to ascertain the profitable metallurgical recovery, after having inquired thoroughly into the question of cost and made several solemn guesses at the persistence of the ore—having solved these preliminary problems, the engineer is to choose between 5, 10, 20, or even 40% as the rate of return required to justify the "investment."

The elaboration of any calculation should be proportioned to the possible accuracy of the factors involved. Otherwise it fares no better than the New Jersey farmer's method of weighing sheep. The animal is attached to one end of a fence-rail while a bag of stones is attached to the other end. First the exact centre of the unloaded rail is ascertained, then the sheep and the bag of stones are fastened at an exactly equal distance from the centre, or fulcrum, and a perfect balance is obtained. When all this has been done with painstaking care, the bag is emptied on a clear bit of ground and the weight of the stones is guessed. Why not guess at the weight of the sheep in the first instance?

Obviously, therefore, mines are not to be appraised on the basis of an investment. Whether iron or coal mines are so different from those yielding the precious metals, or copper, lead, and zinc, as to warrant a different treatment, I leave it for others to state. My own experience has been chiefly in gold and silver mining. In the case of gold, one factor, namely, the market price of the metal, is eliminated. Just now the price of the base metals is subject to abnormal fluctuations, but even in peaceful times this element of uncertainty is an essential part of the business. Some of the bigger copper mines have reserves so large and operations so systematic that the perturbing factors are apt to be forgotten. Promoters and brokers speak of such steady producers as "manufacturing propositions," meaning that they are on an enduring basis. This, of course, is balderdash. A mine is a wasting asset. It has no goodwill; that exists in the management and is transferable to another mine, but it does not ensure the life of a particular property. The resources of a mine are not renewed; at some stage in its history they are under-estimated and conjectural, but that does not mean that they are increased; they are merely uncovered. The art of mining cannot be applied on scientific principles until two basic ideas are fully comprehended:

(1) A mine is a wasting asset.

(2) Mining is a speculative business.

To treat a mine as an investment, and to appraise it on that basis, is to ignore the cumulative facts of today and of other days. Mining is a speculation that can be made wise or foolish according as a man recognizes the inherent risk and takes his chances accordingly. As a speculation it is highly profitable when conducted intelligently. The ascertainable factors are

sufficiently numerous to place a premium on trained observation and the inferences therefrom are sufficiently valuable to give an advantage to men of intelligent experience. The unknown and unknowable elements in the problem will remain so numerous and so important as to involve a risk so large, and the chance of a winning so big as to stimulate the adventurous spirit of man.

### MIDVALE STEEL & ORDNANCE CO.

Boston—Marcellus Hartley Dodge, who headed the stockholders' list of Midvale Steel & Ordnance Co. with 439,000 shares on Oct. 15, had reduced his holdings to 93,800 shares early in November, according to the company's own records. Midvale sold at \$77 a share at mid-October and rapidly advanced to its highest level shortly thereafter. It would appear from the records that Mr. Dodge had parted with 345,200 shares at or near the highest prices.

Although the company was formed a short time ago it now has a substantial number of stockholders as approximately 1,700 names were on the shareholders' list early in November. Notwithstanding his heavy sales, which netted him a huge profit, Dodge still outranks all other holders with the single exception of Ambrose Monell, president of the International Nickel Co., whose holdings of record give him a lead of 106 shares over Dodge. Filor, Bullard & Smyth, which firm came out of the New York Stock Exchange firm of Thompson, Towle & Co., of which Wm. B. Thompson was senior member, ranks third among the large Midvale holders.

Wm. E. Corey, with 42,084 shares in his name, Percy and William Rockefeller, John D. Ryan and others well known in the copper world, have large amounts of Midvale to their credit.

On Oct. 15 there stood in the name of Marcellus Hartley Dodge 439,000 shares. When a compilation of the stockholders' names was recently made he was down for 93,800 shares. Ambrose Monell had two blocks of stock in his name, one for 53,906 shares and the other for 40,000 shares, totalling 93,906 shares.

### THE PURCHASING POWER OF GOLD.

Gold now possesses a purchasing power in Great Britain of only 70 per cent. of what it did before the war, according to a compilation by the London Board of Trade. Reduced purchasing power of fixed interest bearing investments is shown in the following tabulation:

8%	now is equal to 5.6%	in July, 1914.
7	now is equal to 4.9	in July, 1914.
6	now is equal to 4.2	in July, 1914.
5	now is equal to 3.5	in July, 1914.
4	now is equal to 2.8	in July, 1914.

To put it in another way, in order to possess the same purchasing power, an investor receiving interest at the rate of

4%	in 1914 should receive 5.71%	now.
5	in 1914 should receive 7.14	now.
6	in 1914 should receive 8.57	now.
7	in 1914 should receive 10.00	now.
8	in 1914 should receive 11.42	now.

The figures bear out Sir J. Harwood Banner's view, expressed in the House of Commons, that 6 per cent. is no longer a fair rate of interest on capital.



## PROSPECTING GOLD GRAVEL WITH KEYSTONE DRILLS

During several recent field work seasons the work of prospecting beds of gold-bearing gravels has been carried on in the neighborhood of Barkerville, Cariboo mining division, British Columbia. This work has been undertaken chiefly with the object of determining whether or not the general average gold value of the gravel is sufficient to warrant putting in gold-dredging plant. Last year Mr. J. D. Galloway, assistant mineralogist for British Columbia, investigated mining conditions in Cariboo division, and later his official report was published. The following information, relating to drilling operations, has been taken from his report:

In connection with the drilling operations it would be well to first describe the physical character of the country drilled—viz., Williams creek and Willow river. Williams creek flows through the town of Barkerville in a northerly direction, and a mile below the town it turns to the west and flows into the Willow river. The channel of Williams creek has been fairly well worked out by the old-timers by means of drifting operations. This channel varies from nothing up to 100 ft. in depth, and from the town of Barkerville down, the upper 20 ft. now consists of tailing from old hydraulic workings farther up this and in tributary creeks. The continuation of the channel containing pay-dirt beyond Williams creek is a matter of considerable controversy, as it may have gone down into Willow river, as the water now goes, or it may have swung off into another valley.

The Cariboo Goldfields was a hydraulic enterprise on Williams creek, a mile below Barkerville, which was operated for a time. The greatest difficulty there was obtaining a sufficient grade to carry off the tailing, and to this end a bucket elevator was installed which at first was not a success. After overcoming certain mechanical difficulties, the company unfortunately ceased operations.

Practically all the ground along Williams creek down to and including part of Willow river has been secured by John Hopp and associates. Parts of this were drilled in 1913 by a Mr. Dawson, representing Eastern capitalists. These results were said to have been unsatisfactory, but were not considered conclusive. A more systematic drilling campaign was carried out during the summer and fall of 1914 by J. T. Towers. A cross-section of holes was put down across the Williams creek channel just below Barkerville, another one 3,000 ft. below that, and another 8,000 ft. below. The drill was then moved down to Willow river and a series of holes commenced there. When I visited the district the drill was at the latter place, but operations had been stopped for the winter about that time.

The exact figures which would tell the results of this drilling are, of course, confidential and could not be made public. It may be said, though, that a large area on Williams creek has been partially proved to carry sufficient value to be called first-class dredging-ground. The pay value apparently does not extend all the way to Willow river, but the results at Willow river again show pay value, although sufficient drilling has not been done to indicate the extent of the area.

Before describing the actual drilling operations it will be well to consider the important features for the successful operations of a gold-dredge. These may be enumerated as follows:

(1) A sufficiency of gold, in a free state, to pay; this will, of course, vary with conditions.

(2) A soft bed-rock for the dredge-buckets to work on.

(3) A gravel bed which has not too great a depth; at present somewhere about 80 ft. would seem to be the maximum.

(4) A sufficiency of gravel to admit of a large enough amount being earned to pay back both capital and interest of the cost of the necessary plant.

With the exception of No. (4), which is a basic postulate that may be applied to all forms of mining, these conditions may vary within considerable limits, and generally it may be said that the richness of the ground determines whether or not other features not favorable can be overcome. For instance, with a rich deposit it is possible to operate with a deeper cut than on a low-grade deposit. Again, the gold might be contained in a layer of gravel some distance above bed-rock, and in this case the importance of having soft bed-rock would be minimized. The presence of many large boulders in the gravel-deposit adds considerably to the cost a yard of operating; in a deposit containing many boulders, therefore, higher value would be required than in one free from boulders, and vice versa. The amount of gold in the gravel can be closely approximated by careful testing of the ground, generally by drilling.

Along Williams creek and Willow river the bed-rock consists dominantly of soft schists and slates and presents ideal conditions for dredging, as the buckets could easily lift 2 ft. of the rock bottom and thus get all the gold in the crevices. Also, as a rule, the ground is very free from boulders. The depth of ground is the most unfavorable feature of this section for dredging. But there is, nevertheless, a considerable part of the area that is within the dredging limit. Also the depth to which the dredging can be carried is to some extent dependent on the values; that is, if sufficiently rich ground is found dredging could possibly be carried to 100 ft.

The Williams Creek area would require that a large type of dredge be installed; such a dredge could be roughly estimated to cost \$500,000 when erected. This may seem high, but it must be remembered that all costs for freight, supplies, and wages are very high in the Barkerville district. Modern dredges are mostly operated by electric power; as there is no electric power in the district, some of the waterfalls would have to be hydro-electrically developed, which would mean a further outlay of capital.

It cannot be said that a sufficient quantity of ground has as yet been proved on Williams creek to warrant the expenditure necessary for a complete dredge-installation, but in the event of a similar area being proved on Willow river, the two together might form an attractive dredging undertaking. The one electric-power plant and dredge would do for both areas; when the dredge had finished at one place it would either be dismantled and moved to the other, or, if any value was obtainable en route, it would dig out a channel for itself between the two.

The drilling so far done is simply preliminary prospecting, which would be followed later by a complete testing, by putting down holes every 100 ft. In this way the whole ground is mapped out in squares, and from the results contour-value maps are made up. The dredge-master then knows the conditions everywhere—where the deep ground is, and where the values are, etc.

The drilling operations have been carried out under the direct supervision of J. T. Towers, a specialist in drilling engineering, who showed me great courtesy in



explaining and describing the work. The drill used is a large-sized Keystone drill equipped as usual. Some difficulty was experienced in getting suitable pipe, as the ordinary cast-steel pipe crystallizes, under the repeated blows of the hammer, and either breaks off then or later when attempting to remove it. Wrought-iron pipe is the only satisfactory pipe, and to get this it was necessary to send to Pennsylvania; considerable delay was occasioned in freighting this in.

It may be worth while to describe the exact modern method of testing supposed placer-ground by means of a Keystone drill. The machine consists of an upright boiler and engine mounted on a frame running on wheels, and so arranged that the engine operates a hammer or weight up and down a guide on the same principle as a pile-driver. This weight is raised and then dropped by gravity on the butt of the pipe, which is, by the impact, driven into the gravel. The pipe used is 6 in. in diameter in the clear, and is made in 10-ft. lengths. The joints are screwed together, and the upper section screws down until it rests on a flange around the inside of the lower section, the flange thereby taking the impact of the blow and not the screw-threads, which would soon be ruined by repeated hammering. The first length is equipped with a head similarly screwed on, which takes the blow of the descending hammer. When this length is driven down far enough, the head is unscrewed, another length screwed on, and the process repeated. The first section of pipe to be put down has the lower end flared out all round to form a cutting-edge which is  $7\frac{1}{4}$  in. in diameter. This pipe-casing is generally driven down a foot at a time; theoretically, in close-packed gravel, an advance of one foot of the cutting-bit would give 1 ft. 6 in. of gravel in the pipe, but this varies considerably with different kinds of ground. After driving a distance of 1 ft., a bit is put down inside the pipe and the gravel churned up and then extracted by a suction pump. Wherever the drill is passing through ground that is thought to contain gold, the drill is only advanced a foot at a time; but when a layer which is known to be nearly devoid of value is being passed through, then advances of 6 to 8 ft. are made before extracting the core. Invariably, when possible, the pipe-casing is driven ahead and the core extracted after, but if a large boulder is encountered it is necessary to put down a heavy bit and drill through it before the pipe can be driven ahead.

The gravel extracted is run through a rocker and carefully panned, a record for each advance being kept. In extracting the core, care is taken not to remove so much as to go deeper than the end of the bit; as a rule, an inch or two of a gravel cushion is left in the bottom of the hole to ensure that no material shall be drawn in from beyond the periphery of the hole. As the work proceeds exact measurements of the distance driven are recorded at each advance, amount of gravel extracted, and the cushion of gravel left behind. In this way the amount of gravel and value obtained along each section of the hole (whether one foot or more) is ascertained. The value of the gold colors obtained from panning the gravel from each advance (say one foot) is estimated by eye, and then at the finish the total gold from the hole is weighed. It is significant of the accuracy of this eye estimation to say that Mr. Towers showed the writer a log-book of several holes, and in these the total gold in a hole by estimation did not vary from the weighed amount by more than 2 or 3 per cent. When it is considered that the total gravel in a hole of this diameter,  $5\frac{3}{4}$  in. and 100 ft. deep, is

just about 1 cu. yd., and that 25 cents a yard would be good-grade dredging-ground, it may be realized with what minute quantities of gold this eye estimation has to deal. The character of the material through which the pipe passes is carefully noted; also the time of drilling, which gives a good indication of the hardness and whether or not the gravel is cemented. In fact, every detail is noted and the log-books show a volume of information which is of great use later on if the ground is dredged.

The drill is generally kept going 24 hours a day, but even if not in operation, a watchman is kept on it to prevent any possibility of "salting" the hole. When a hole is completed—that is, when it is down to bed-rock, or in some cases before that, when the ground is too deep—the casing is withdrawn and the "hole" disappears by filling in. The casing is removed by hammering up against the head instead of downward, and removing a section at a time as it comes up. The pipe is much more liable to break at this stage than in the driving, owing to the unequal strains set up. If the pipe breaks much below the surface, it is generally impossible to recover and has to be abandoned.

In conversation with me, Mr. Towers expressed himself as being well satisfied with the results of the drilling so far done, and seemed very hopeful that the ultimate dredging of large areas of the Barkerville area would be accomplished.

#### THE ADVANCE IN SILVER.

Boston—An over-night discovery that the stocks of silver in London were far below what had been credited to that centre by the banking interests was the immediate cause of the recent rise in price which has carried the metal across 56 cents an ounce. It was 46 cents only a few weeks ago.

For a considerable time the weekly reports of silver stocks in London did not vary much from £1,500,000. Nobody ever thought of questioning the accuracy of these statistics which were put out by several dealers in silver. Finally, an accounting was made and it was learned to the consternation of all concerned that the actual stocks were but £750,000, an amount far too small for safety, and buying immediately began.

When prices started to move upward it started a general laying in of stocks for coinage requirements and the price advanced to above 56 cents an ounce. One South American country bought 4,000,000 ounces in New York, although it had always before bought its requirements through London. A Scandinavian country took about 1,000,000 ounces. Other buying has been of heavy proportions. But the chief factor has been the buying to fill up silver reserves in London.

China and India use large quantities of silver for coinage, and purchases for those countries invariably affect the market. One of the best posted men on silver in the country who has the marketing of large quantities, sums up the situation as follows: "Silver is the basis for international finance between the Far East and London just as gold is between London and New York. It is probable that fully ten times the amount of silver stored against exchange in these operations would be needed if actual settlements were to be demanded. This in a word indicates the strength of the silver situation. It is not generally known here that dealers in exchange between Europe and the Far East generally buy or sell silver as a hedge against their exchange operations."



# THE EVOLUTION OF ORE-DRESSING METHODS\*

By Robert H. Richards.

The primitive metal worker picked out the rich specimens by hand and then smelted them. He next washed the ore pile to make the picking easier. He then noticed the small sizes of ore grains collecting in eddies and ripple marks, concentrated by the flowing of the water, and scraped up these. He then ran the mine fines through a trough, and collected the small grains which were left behind. He now found that by putting in riffle blocks he could increase the catch. In this way, the wash trough for ore was developed and finally, at a much later date, the riffle sluice for gold.

The next step in the evolution of ore dressing methods probably came by watching the waste flow away from the tail of the wash trough and build up a sand bank which was rich at the upper end and poor at the lower. From this, he constructed a second or lower trough, from which the building buddle was developed. He found that by sweeping transversely he could greatly aid in keeping the values at the upper end. This combination of a wash trough with riffle cleats and a building buddle is so efficient that it is to-day one of the most valuable prospector's tools, where the prospector is beyond the reach of modern mills and wants an approximate valuation of the concentrating qualities of the ore.

After getting the fixed building sweeping buddle (intermittent) he next made the Freiberg suspended building buddle (intermittent) with cam spring and bumping post. Then Ellenbecker invented his surface jerking table (continuous) at Calumet and the Gilpin County bumper came next in Colorado. Frue followed with his belt vanner, which is extensively used to-day.

While these improvements were in progress for two-mineral separation, Rittinger invented his continuous side-bump table with the bumping action at right angles to the flow of the water, separating the feed into several products according to weight and size. This was followed by the Wilfley table, which is one of the greatest advances ever made in ore dressing. It depends on the jerking progressive motion acting at right angles to the flow of the water and on the diagonal line of mechanical control of the separation.

The hand sieve for cleaning and hand-picking, when used in a wash tub, must have very soon developed the principle of the jig, and next came the mechanical design for the hand jig with moving sieve. It was then arranged with a cam to be run by power. Some bright mind then said, "we are moving the sieve and letting the water stay still; why don't we move the water and let the sieve stay still," and from that thought came the plunger jig. Then the jig was fed and discharged tailing continuously, the concentrate being skimmed off periodically and the hutch drawn off. Then the discharge for concentrate, with gate and dam, was introduced. This made the jig the entirely continuous machine which is in use to-day in the modern mills. Devices for softening the suction action, which tends to blind the screen, met with favor and have become part of the mill man's equipment. Among them are the sliding block, the crank arm, the Collom jig with spring, and the new Century jig with spring.

The Woodbury jig, by a combination of deep bed and gate and dam discharges at graded heights, combines jigging with removal of slime. The pulsator jig overcomes screen blinding entirely and increases the capacity of a jig many times on account of the extremely

soft bed it maintains. The Hancock jig of very large size—with moving screen divided off into compartments producing different grades of products, using little water and power, but with very large capacity, 400 tons or 500 tons in 24 hours, ranging in size from 8 mm. to 2 mm.—seems to be the climax in jigging at the present time.

In slime concentration, an early form of table is the Cornish frame, a plane surface, sloping from feed end to tail end, over which slime flows. Periodically, the feed is stopped and the concentrate flushed off. Following this came the convex, revolving, conical, round table which is a continuous-acting machine, feeding, washing, and discharging concentrate and tailing without stopping to discharge concentrate—a most useful table. The fixed blanket table for catching concentrate, and especially gold, was an early development.

In gold working, the canvas table, rectangular in form with a surface of cotton duck, run like a Cornish frame, has been much used. When fed with extremely fine slime, as in the Gates canvas plant, this is at its best, and is a very efficient machine. The Taylor Woodworth experiment at Lake Superior was intended to make the Gates system more automatic with less labor costs, flushing 25 tables, more or less, at once; but for various reasons it was discontinued. The most pronounced success, and the climax of the series, is the Anaconda rough surface, convex, conical, round table with very slow revolution and fed with extremely fine slime. This has accomplished more and better work than any of its predecessors.

**Flotation Process.**—Devices depending upon surface tension, or as it is sometimes called, "greasy-flotation," are destined to play an extremely important part in the concentration of fine ores. They depend upon the great aversion that some minerals (metallic, sulphide and some oxides and carbonates) have to being wetted with water, which is increased by a film of oil on the mineral particle, while others have little or no aversion. The minerals which are difficult to wet with water are easily wetted with oil, even in the presence of water, while those that are easily wetted with water are not easily wetted with oil in presence of water. A little acid increases this differentiation in both directions.

If dry particles of pyrite and quartz 0.01 inch in size are lightly dropped on water, the pyrite particles will almost wholly float on the surface while the quartz particles will almost wholly sink, due in the first place to the surface tension, or aversion of the pyrite to be wetted, and in the second place, to the ease with which the quartz is wetted. If the quartz and pyrite are stirred violently with water and a very little oil, the oil is selective and attaches itself mainly to the pyrite and but little to the quartz; the presence of a little sulphuric acid increases the attraction of pyrite for oil, and the aversion of quartz for oil. If in any way small gas bubbles are introduced into the mass, they adhere to the pyrite, but not to the quartz. The bubbles act like life preservers and float the pyrite grains up to the surface. This scum or froth can be skimmed off, carrying with it the pyrite, and the quartz will be left behind.

There are many ways of getting the minute bubbles needed: carbon dioxide from the action of sulphuric acid on dolomite or siderite, sulphuretted hydrogen from blende or pyrrhotite and acid; air blown in in fine bubbles; vacuum fire bubbles of dissolved air to

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be drawn out of the water; air forced into water under pressure effervesces when pressure is removed; water as it begins to boil liberates fine bubbles of air. If oil is used in larger quantity, it floats up the sulphide by its buoyancy.

If quartz blende and galena are treated as above, the blende and galena will be found in the scum or froth; but if they be given a brief roast beforehand, the galena with slight coat of oxide will sink with the quartz and the blende will float in the scum. The galena can then be separated from the quartz by the concentrating tables.

If fine magnetic sand be mixed with the ore while the oil is being stirred in, the magnetite forms a catching nucleus for the ore, and the scum so formed can have the oil removed, to be used over again, and then the magnetite can be separated by magnet from the values.

The pneumatic riffle table (Sutton, Steele and Steele) avoids the use of water in concentrating ores where water is scarce.

The Plumb air jig is proving a valuable helper in separating certain concentrate products where the wet machines do not give perfect enough separation, for example, blende from galena.

**The Magnet.**—There are three leading conditions, and consequent processes, whereby the magnet may be used for separating the mineral grains that are attracted from those that are not. (a) Minerals that are strongly magnetic (b) minerals that are weakly magnetic, and (c) minerals that are not magnetic but may become so by suitable treatment.

(a) Strongly-magnetic minerals may be separated from others, whether or not of the same specific gravity. Many magnetic machines have been devised; perhaps none has more capacity or is more efficient than the Ball-Norton belt machine. This, by its numerous magnetic poles of alternate polarity—the earlier of stronger magnetic force, the latter of weaker—will separate, first, a tailing of no commercial value, next, a middling for re-crushing and re-treatment, and, finally, a concentrate for the furnaces. This concentrate is made especially free from the non-magnetic minerals owing to the alternate polarity of the poles, which causes the tufts of mineral grains to be inverted with every new pole, and thus the less magnetic or non-magnetic grains are sifted out from their entanglements.

(b) For weakly-magnetic minerals, a number of high-power magnetic machines have been devised, among them perhaps none has more efficiency than the Rowand-Wetherill magnet. These magnets can separate minerals that have so little magnetic susceptibility that they show none of it to a strong, permanent hand magnet. For example, limonite may be completely separated from quartz. Again, monazite may be completely separated from garnet and hypersthene (more magnetic minerals) and from zircon and quartz (less magnetic minerals).

**Differential Magnetic Work on Weakly Magnetic Minerals.**—A little 6-inch Wetherill magnet (Rowand type) at Portland, Oregon, separated black sand by repeating the treatment each time with increased amperage, the minerals taken out were as follows: With 0.2 amperes electric current the magnetite was taken out; 1.1 amperes took out the ilmenite; 1.6 amperes, the chromite and platinum; 1.75 amperes, the garnet; 2.2 amperes, the hypersthene and olivene; 3.5 amperes, the monazite; leaving zircon and quartz, gold and iridium as non-magnetic.

(c) The separation of dark-colored blende from pyrite is generally in class (b), the blende being the weakly-magnetic mineral, but with resinous, light-colored blende (commercially non-magnetic), the process is more complicated. The pyrite is coated on its surface with a thin film of magnetite or pyrrhotite by a brief oxidizing roast; the product so prepared easily yields to the treatment described in class (a). A 1 mm. grain of pyrite exposed between one and two minutes to oxidation at a red heat reaches maximum magnetic properties; with longer time or shorter time, it has less magnetism.

In separating siderite from resinous blende, the procedure is as with light-colored (non-magnetic) blende, where the roasted siderite is the magnetic mineral only. The exposure required in the furnace is to a higher heat and for a longer time than with pyrite.

Static electricity from a frictional machine effects a separation on certain minerals of the same, or nearly the same, specific gravity. If a conductor, for example, a brass cylinder, is charged with one pole of a static machine and grains of sand of mixed minerals are dropped on to it, the good conductors will at first stick tight to the cylinder, but as soon as fully charged, will fly off into space. The poorer conductors do the same, but it takes them a longer time. The current from a dynamo will do the same, provided its voltage is sufficiently high. An alternating current has a special advantage in that it gives three products: (1) very good conductors, which fly off immediately; (2) a middling, which does not get sufficiently charged before the current is reversed, and so sticks to the pole (they have to be brushed off the pole); and (3) the very poor conductors, which simply tumble off the cylinder as it slowly revolves.

**Breaking.**—Very early in the scheme of concentration the use of the hand hammer for cleaning the values from the waste came in. This was followed later by hammers driven by power, or crude stamps. These were gradually developed until the California stamp was evolved.

Gravity stamps are common, weighing 1,000 lbs. to 1,200 lbs. or even 2,000 lbs., crushing down to  $\frac{1}{4}$  inch maximum and to 1-30 inch minimum. A recent design has a cam with uniformly accelerated motion which saves some power and most of the noise.

The rock breakers of the Blake type were introduced to do away with the heavy work of coarse breaking by hand.

**Rock Breakers** of the Blake type are standard for milling work. They are made up to 24 inches by 36 inches jaw opening. One firm makes one much larger than that. The larger sizes break to 4 inch, the smaller to  $1\frac{1}{2}$  inch in size.

The Dodge breaker is used in places where a constant maximum limit in size is especially important. They break down to 2 inch or even 1 inch.

The Gates and McCully spindle breakers are used for taking the run of mine and bringing it down to some uniform maximum size; 4-inch size is common for the large machines. The smaller machines crush to 2 inches or  $1\frac{1}{2}$  inches.

Rolls are standard for intermediate breakers. They are made as large as 54 inches by 18 inches for the greatest capacity and efficiency. Belted rolls are much more common than geared rolls. They break to a maximum of about 1 inch and to a minimum of about 1-16 inch.



Chile mills and tube mills, cylindrical or conical, are prominent machines for fine crushing preparatory to concentration. Their breaking limits range from 1-16 inch, or  $1\frac{1}{2}$  mm., maximum, down to 1-50 inch., or  $\frac{1}{2}$  mm. minimum size; tube mills are universal for the finer sizes. In some cases, the tube mills are required to break much finer. The finest limit may be 0.08 mm., or 3-1000 inch.

Steam stamps weigh up to  $2\frac{3}{4}$  tons and usually crush conglomerate at the rate of 300 tons per 24 hours from 3-inch down to 3-16-inch, and amygdaloid at the rate of 600 tons per 24 hours, from 3-inch down to  $\frac{5}{8}$ -inch.

**Improvements in Milling.**—In the Lake Superior copper region, the improvements that have done the most to reduce waste and increase yield are: (1) the mortar discharge, which removes copper nuggets from the steam-stamp mortar almost as soon as they are freed from rock. Formerly these nuggets remained in the mortar and were abraded, yielding much fine copper slime—too fine to be saved. (2) The use of a coarse stamp discharge screen,  $\frac{5}{8}$ -inch round hole and a trommel  $\frac{1}{4}$ -inch hole, giving a chance to catch  $\frac{5}{8}$ -inch to  $\frac{1}{4}$ -inch nuggets or an outside jig or hydraulic classifier and saving much sliming of copper. The  $\frac{5}{8}$  to  $\frac{1}{4}$ -inch jig tailing is re-crushed and put back into the system. (3) The re-crushing and washing of all coarse tailing for the recovery of included grains of copper.

At Anaconda, Montana, the latest flow sheet shows that the rock will be crushed primarily to 7 mm. and then screened on a  $1\frac{1}{2}$  mm. screen; the oversize yields concentrate on Hancock Jig and the middling is re-crushed to  $1\frac{1}{2}$  mm. The primary and re-crushed ( $1\frac{1}{2}$  mm. to 0) materials go to an Anaconda classifier, yielding slime (.08 to 0 mm.) for flotation and sand for Wilfley tables. The middling from these (no tailing is made) goes to tube mills and Anaconda classifiers, making slime (.08 to 0 mm.) for flotation and the sand returns to the tube mills. The primary flotation will yield two products, low grade concentrate and tailing with .08% copper. The primary concentrate will go to secondary flotation and yield high grade concentrate and middling. This last will go back over again to the primary flotation. The yield of a final tailing with only 0.08% copper is a most extraordinary achievement.

The improvements in Missouri Lead, Idaho Lead and Arizona Copper are along the same general lines as Montana, namely, jigs for coarse sands, classifiers and tables for finer sands, and flotation for the slime. The limit at which re-crushing stops is much coarser in the lead and silver-lead mills than in the copper mills, owing to the lower value of the chief metal value.

The importance of classification preparatory to Wilfley-table work seems to be everywhere admitted; by it the fine free mineral losses in Wilfley-table tailing are mostly prevented.

The porphyry coppers of Utah and Arizona generally use a roughing riffle table; the tailing from this goes to classifiers and the various products to vanners—the corrugated belt for the coarser sizes and the smooth belt for the finer. Flotation has been taken up and is to increase the saving on the older method very greatly. The wonderful success of the porphyry copper mines seems to have been due to the insistence on enormous capacity, even if high saving was not at first attained. Now the high saving is coming through the flotation process.

The Timber Butte mill of Butte, Montana, gives a very good example of the most advanced methods used on complex ore, combining water concentration and

flotation. The ore, carrying zinc, lead, copper, gold and silver, is crushed to  $2\frac{1}{2}$  mm. Roughing tables then give (1) mixed minerals, (2) coarse zinc and (3) slime. The mixed minerals (1) by classifiers, jigs and tables give (A) lead, (B) mixed minerals and (C) coarse zinc. The mixed minerals (B) are re-crushed to 20 mesh (probably  $\frac{3}{4}$  mm.), then classifiers, and tables give (a) lead, (b) mixed minerals, (c) coarse zinc, and (d) slime. The mixed minerals (b) are re-crushed to 60 mesh (probably  $\frac{1}{4}$  mm.), and all the slime added to them. Flotation separates the (1) zinc and lead from the silica and insolubles. Then wet concentration upon the flotation zinc and lead gives (1) lead and (2) fine zinc, yielding a high extraction of zinc, lead and copper. The silver and gold are distributed in with these other metals.

### METALS AND MUNITIONS.

Copper, zinc, aluminum, nickel, and other metals being of such enormous importance in the production of munitions it is not surprising to learn that the Institute of Metals (which takes within its purview all metals except iron and steel), is very closely concerned with the production of the thousand and one metal articles required for the successful prosecution of the war. The Institute is in daily touch with many of the munition factories throughout Great Britain, and also with certain Government Departments requiring metallurgical information. As an indication of the utility of the publications of the Institute of Metals (particularly at the present time) it may be mentioned that large shipments of the Journal of the Institute of Metals, in which are recorded the very latest scientific methods of dealing with the non-ferrous metals, are being despatched to Japan and the United States for use in works engaged in producing munitions for the allies. In addition, volumes are being sent to various public and university libraries located in the United States' munition centres. German submarines have taken toll of large consignments which were sunk in the Hesperian and the Arabic, but duplicate sets of volumes have now replaced those lost in this manner. The volumes are supplied gratuitously to members—numbered among whom are most of our important munition makers—but copies can be purchased by non-members from the offices of the Institute of Metals, Caxton House, Westminster.

### TOUGH-OAKES' DIVIDEND.

Cobalt, Dec. 3.—A second dividend of  $12\frac{1}{2}$  cents a share, the rate of 10 per cent. per annum, has been declared by the Tough-Oakes Gold Mines. The par value of the stock is \$5 a share. The second dividend, just declared, is payable January 3, 1916. This makes a total of 25 cents a share from Tough-Oakes since it went on a dividend basis. The dividend record is as follows:

November 5, 1915,  $21\frac{1}{2}$ %, \$65,125; January 3, 1916,  $21\frac{1}{2}$ %, \$65,125.

### GLEN LAKE MINING CO.

Cobalt, Dec. 3.—A three-ton shipment of high-grade ore was made from the Foster mine last week by the Glen Lake Mining Company, lessees of the Foster. The ore was taken from extensions of the Lawson veins running into Foster territory. This pocket of ore was exposed for some time, but was left in the ground until the price of silver advanced.



## A RACE WITH STARVATION

By J. Harmon Patterson.

We left the sound of the locomotive whistle about the middle of March, bound for Clear Lake, about sixty miles distant as the crow flies, on a prospecting trip. It was Bill Bateman's maiden trip, but he knew how to handle a paddle with the best, and this counted for much. He was strong, willing and cheerful withal, good in an argument and a good listener, which qualities tend to make the ideal companion, when you are cut off from the rest of the world for months at a time. Then I had as guide Indian Charlie, one of the few Indians I ever knew on whom I could absolutely depend. He had been in the country to which we were going and knew it well.

We took in with us five hundred pounds of supplies. This we supplemented by much moose meat purchased from an Indian trapper. It was our plan to explore the country as well as possible before the break-up, so that we would have definite information when real prospecting would be possible. I was employed this season by a syndicate who trusted to my judgment in choosing territory, and I was very anxious to make good if possible.

Indian Charlie brought in our canoe as far as Otter Lake and it was our intention to move camp to that point before the streams would open, having our supplies in cache at Clear Lake.

It was late in April when we arrived at Otter Lake, having been delayed rather long, and consequently we did not bring with us as much provisions as previously intended. We proposed making a round trip, making a preliminary examination of the country, and arriving back at Clear Lake on the last of our supplies. Then would begin the more detailed examination of the country we had laid out.

We set out from Otter Lake on the third of May. The stream we followed was not used by the Indians. It was very rough and very crooked, and where we could not let the canoe down a rapid by the lines we had to cut out our portages. As the snow was yet deep in places, we had to use snow-shoes.

The next stream was also very swift, and if possible more crooked than the last. It flowed into a much larger river, up which we went against a swift current which made progress very slow. This river we left on the fourth day for a small creek and for two days we fought our way up its tortuous course.

Then our misfortunes began. While making camp at night on a rough and rocky portage Bill drove the axe deep into the side of his foot. We hastily took off his shoe-pack and sock, and as the blood spurted out in great gushes I saw that the artery was severed. By the aid of a rough tourniquet I checked the flow of blood, but what to do next I did not know. Charlie suggested flour. We plastered it on the wound and bound it up with cloth, then more flour and more cloth. Taking off the tourniquet the blood did not show. We then laid Bill on his back and slung his foot above the ground by a line from the tent pole.

Next day we took stock of our provisions. We only had enough to last about four days. Bill suggested that we start at once for the cache while we had something to eat, but this was obviously impossible as he might bleed to death. Charlie said that we must stay till we were sure that the foot was all right. In the meantime he would hunt for game. If there were rab-

bits it would be all right, but if there were none all we could hope for would be squirrels, partridge, muskrat, and perhaps a porcupine. Charlie proceeded at once to make a bow and some arrows, and I was greatly surprised at his accuracy with this crude weapon.

We hunted early and late but our total bag of game for five days was eleven red squirrels, five partridge, three muskrats and one porcupine.

We were in an awkward predicament. Bill's foot was still in danger, but it seemed to be healing nicely. We decided that we must make a trip to the cache and return for Bill. We could not expect to return from our cache in less than five days and we did not have two days' provisions for one man. All that we could leave was about half a pound of pork, a good handful of flour and a dozen squares of condensed soup. For ourselves, though we took plenty of tea, we had to depend on game which we would see along the shore or on the portages. To secure this we must depend on a very crude weapon.

Had we been well fed before starting it would not have been so serious but for two days we had been on less than half rations, and the trip would be a hard one.

Next morning early we set out for the cache. We left Bill with plenty of wood. There was good water a few feet from the door of the tent. We took a pair of blankets, a rubber sheet, an axe, a small tin pot, our snowshoes and the bow and arrows. We quickly passed through Beaver Lake, and portaged into the creek again. We made two portages of about half a mile each, then a small lake. The stream above this lake was very narrow, very swift and very crooked. We came to a rapid and thought we could paddle up, but found it too swift. The shores were perpendicular rock, so we began to let the canoe back. How it happened I do not know, but in a twinkling I was in the water and being whirled down in the current. I thought of Bill, of his waiting and watching for our return while he slowly starved to death, and I saw him at last dead in the tent terribly thin and white. All the energies of body and mind were bent on finding a footing in the rushing, boiling water. After what seemed an age I managed to secure a hold on a rock and from it I worked my way into shallow water. Down below I saw Charlie. He was clinging to the canoe and soon reached the shore. We found the paddles, bow and arrows and snowshoes, but there was no sign of the pack. We mourned most our blankets and tea, but it was no use turning back, so we made a portage and went on.

We fought our way up that stream and late in the afternoon came to the lake. A plainly marked portage showed and we took it without hesitation. Some of it was bare, but in places snow was deep. It was a good mile long and before we reached the other side it began to rain. The lake we saw in the gathering darkness was long and narrow. We made a cheerless camp on the shore, collected all the wood we could find and made a fire. Then we leaned the canoe up into a tree so that we could stand under it. Hungry, weary, wet and cold we stood or walked around the fire. Oh, for a dish of hot tea! We had not seen a living thing all day and I began to despair of our reaching the cache. Charlie inquired how many holes in my belt. I said "About six." "Maybe that will do," he replied. He never complained once.



At the first sign of dawn we tried the lake. The ice was rotten and would not hold us. We secured two long dead tamarac poles and placed one on each side of the canoe. Then with one foot in the canoe and the other on the pole we drew the canoe to the end of the pole, which we then pushed ahead. After half an hour of this work we found the ice strong enough to bear us and we were nearly across before it became necessary to use the poles again. Along the shore was an open channel, which we followed, looking for the portage and occasionally drawing the canoe over a point of ice. At the extreme south end of the lake we found the portage, and as we came to it Charlie spied a muskrat. Up went his bow. I held my breath. His arrow found the mark and in another minute we had the animal. While I made a fire Charlie skinned our prize. It was then quickly grilled and divided. It was not a very delicious morsel, and not well cooked, but it seemed to put new life into me. We saved the skin and bones, in fact nothing was wasted.

The next portage was very short and the lake itself was much like the last. We worked around the south end as there was considerable open water near the shore. The next portage of three hundred yards let us into another small lake which to our great delight was clear of ice. We soon crossed it and camped on the portage. There was a perpendicular wall of rock some twenty feet in height. In front of this Charlie made up a good fire and the heat reflected from the rock kept us quite warm. Between dozing, sleeping and making up the fire we put in the night.

It was still dark as we packed the canoe over this portage which opened into a deep bay. Coming out of this into a large lake clear of ice, I looked around me. It had a familiar appearance. Yes, it was Brule Lake. One more portage to Clear Lake and plenty to eat. Drawing up my belt a couple of holes I paddled hard and we soon reached the portage. Charlie explained that on shallow lakes the ice melted much earlier than on those which were deep, as the water would be much colder in the latter. He said that we might expect to take the canoe up Clear Lake as far as the point.

We succeeded in paddling up the stream for about a mile on this portage, but when I got out of the canoe I was so dizzy that I could hardly stand. Charlie picked up the canoe and went on as though nothing was the matter. It was all I could do to follow. He put down the canoe at the edge of a small pond and as I came up I saw him seize his bow, fit an arrow and take careful aim. Then I watched the flight of the arrow. He dropped the bow, ran forward and picked up something. I sat on a log sick and dizzy. Another muskrat and just in time. It was soon cooked and eaten. How quickly I seemed to revive, although at first it made me sick. "Guess we are good for the cache now," said Charlie.

"Clear Lake and no ice in sight. What will be first?" I asked.

"Fire, tea, milk, pork, make bread, cook beans," was the reply.

At this point we found the lake covered with rotten ice. Away across on the far shore I could see our camp. Plenty to eat there, but we must take a six-mile walk around. We climbed steep, rocky hills, and waded icy swamps with the water to our waists. At times we were compelled to use our snowshoes. Charlie in the lead, we wandered on. Once after wading a swamp he had to make a fire, as I was completely numbed by the cold. At last we reached the bay behind the cache. Charlie waded out till he found the ice

would carry him. With a stick he tested it as he went along. When he was half way over I followed. We reached the shore in safety and climbed the hill.

The cache was as we had left it. Quickly Charlie opened one end and brought out a chunk of pork. With a knife he cut off a slice and began to devour it raw. I told him he would be sick, but he paid no attention.

I tried some soda biscuits, but could not swallow them. A couple of handfuls of sugar went better. A can of St. Charles Cream was the next item. Charlie left the pork for the cream. Then we set up the stove and soon had hot tea. It seemed to act on every tired nerve and fibre in me.

We soon had pork cooking in a pan and beans in a pot, but this was too slow. I was asked to build another fire so that he could make bread and boil some rice. I ate a good meal but from the amount of provisions which Charlie demolished, I was sure he would be ill. He said, "Lots of meals I missed." I am quite sure that in two days he brought the average up to the normal.

We arranged some tar paper as a screen in front of the fire. I spread an old coat on the brush and tried to sleep, but I was often awakened by the cold as the night was frosty. Then Charlie would shake me. "Eat something?" was always his question. "Let me sleep if I can," I told him once. "Can't go far on sleep," was his answer. "Eat plenty grub, make fast trip back, then sleep," all of which I did.

As soon as it was light we made up our packs. The guide had about seventy pounds, I about thirty. We had now an axe, a tin pail, frying pan, and dishes. We took plenty of pork, flour, tea, sugar, beans, rice, milk and other supplies. The trip to the canoe was hard, but we went further inland and missed most of the swamps.

Charlie thought it advisable to stay at our last camp by the rock. We could have travelled further, but this would be so much more comfortable. He cut a large quantity of wood and made two fires. We also had a good brush bed. I slept fairly well, but woke up very stiff and cold. It was four o'clock, so we made a good breakfast and set out. On our way along the shore we saw a muskrat swimming in front of us. "Want him?" asked Charlie. I declined. What a God-send he would have been on the other trip.

We traveled fast and made our camp that night on the shore of Sog-a-jew-a-wig-a-mog Lake, but did not sleep. It was too cold, and at break of day we launched our canoe for the camp. This stream which had been so hard to paddle against now hurried us along and by noon we made the portage into Beaver Lake. Charlie gave a war-whoop which would carry about a mile. Immediately we heard a shout, so we knew that Bill was alive, and very glad he was indeed to see us. His foot, too, was steadily improving.

After lunch I took off my clothes and crawled into bed. I remember in a vague way of someone rolling me over, but when I awoke it was broad day.

The Cambria Steel Co., Lackawanna Steel Co., Newport News Shipbuilding Co., Youngstown Steel & Tube Co. and either Inland or Iroquois plants near Chicago, are to be merged within next ten days if plans do not miscarry, according to J. Leonard Replogle, head of syndicate which purchased 240,000 shares of Cambria Steel Co. held by Pennsylvania Railroad Co. The consummation of the merger will depend upon capitalists obtaining control of 100,000 more shares of Cambria.



## PERSONAL AND GENERAL

Mr. Robert Livermore, manager of the Kerr Lake Mining Co., is examining the Smith La Bine claims at Sesekinika, Ont.

Mr. Frank Horne of the Dome staff is in charge of the installation of a small plant at the McDonough property in Pacaud township, now being opened up by Mr. Geo. Miller.

Mr. Wasaku Kondo of Tokio, Japan, has been visiting cyanide plants at Cobalt.

Mr. David Sloan, manager of the New Ray mine, has returned to Porcupine from the West.

Mr. A. H. Brown is at the Dome Lake mine.

Lieut. Thorne, formerly manager of the Trethewey mine, who has been recruiting in the mining districts for No. 1 Tunneling Company, is now at Pembroke, Ont.

Mr. John L. Baker, who was in charge of construction of the Tough-Oakes mill at Kirkland Lake, is now on the staff of Moose Mountain Ltd., investigating at Brooklyn methods of treating the Moose Mountain iron ores.

Mr. L. K. Armstrong of Spokane, Washington, has been re-elected secretary-treasurer of the Columbia Section of the American Institute of Mining Engineers, the territory covered by which includes Eastern Washington, Western Idaho, and parts of Oregon and Southern British Columbia.

Mr. Chas. A. Banks, general manager for the Jewell-Denero Mines, Ltd., who left the Boundary district of British Columbia on November 9 for New York, sailed from that city on November 21 by the steamer Philadelphia for England.

Mr. W. M. Brewer has returned to Victoria after having spent the summer and autumn investigating mining conditions in parts of Similkameen and Yale districts of British Columbia, on which he is now preparing a report to be made to the Provincial Department of Mines.

Mr. A. N. Cantril, general manager of the Coalmont Colliery, in the Granite Creek-Tulameen region of Similkameen district of British Columbia, is at Coalmont awaiting the completion of arrangements for a resumption of development work in the coal-mine owned by his principals.

Mr. C. L. Copp, formerly manager of the Coronation gold mine, on Cadwallader creek, Lillooet district of British Columbia, is now manager of the Pioneer mine, situated in the same neighborhood.

Mr. Smith Curtis, at one time interested in copper properties in the Boundary and Similkameen districts of British Columbia but recently giving his attention to mining properties in Ymir and Sheep Creek regions of Nelson mining division, was in Victoria recently, endeavoring to secure capital for mining development.

Mr. A. F. Eastman, of Tacoma, Washington, secretary of the Tacoma Steel Co., owning the Marble Bay mine on Texada Island, B. C., has been on a visit to San Francisco, California.

Mr. Stanley A. Easton, of Kellogg, Coeur d'Alene district of Idaho, general manager for the Bunker Hill & Sullivan Mining Co., who was last month elected chairman of the Columbia Section of the American Institute of Mining Engineers for the ensuing year, was years ago manager of the Gold Drop mine, near Phoenix, B.C., then owned by Montreal men but afterward sold to the Granby Consolidated Co., which has since taken out of that property and the adjoining Monarch

mine about 1,500,000 tons of copper ore. Mr. Frederic Keffer, now of Spokane, Washington, who was elected vice-chairman of the Section, was the first general manager for the British Columbia Copper Co., and developed that company's Mother Lode mine near Greenwood, Boundary district, from a mere prospect to a big copper mine.

Mr. W. J. Elmendorf, of Seattle, Washington, for several years in charge of important mining development in Portland Canal mining division, British Columbia, was a passenger on the Canadian Pacific steamer Princess Maquinna when three or four weeks ago she vainly attempted under dangerous conditions to rescue the officers and crew of a Chilean full-rigged ship that during a most violent storm was wrecked on the southwest coast of Vancouver Island.

Mr. Geo. L. Fraser, at one time managing a coal mine in South-west Alberta, is now with the Granby Consolidated Co. at its big copper mines at Phoenix, Boundary district of British Columbia.

Mr. A. I. Goodell, who was manager of the copper smeltery at Boundary Falls, B.C., during several of its operating years, and afterwards superintendent of the Le Roi Mining Co.'s smelting works at Northport, Washington, was at Seattle and other places in Washington last month obtaining information that will be considered in determining the site of the smelting works to be established for the Bunker Hill & Sullivan Mining Co. Mr. Jules Labarthe, who prior to becoming general manager for the Mason Valley Co. was superintendent of the Consolidated Mining and Smelting Co.'s works at Trail, B.C., has been looking into the engineering side of this projected new enterprise.

Mr. Thomas Graham of Victoria, chief inspector of mines for British Columbia, went to Ravensdale, Washington, last month, where there had been a coal-mine disaster that resulted in the loss of 31 lives. Among other officials who also investigated conditions after the explosion there were Mr. H. M. Wolflin of San Francisco, engineer for the Industrial Accident Commission of California, and Mr. Edwin Higgins, of Pittsburgh, Pa., of the staff of the United States Bureau of Mines.

Mr. J. Cleveland Haas, of Spokane, Washington, last month visited mining properties on Vancouver Island, and on the mainland of British Columbia in Vancouver mining division.

Mr. R. W. M. Hunter left Victoria, B. C., at the beginning of December to proceed to Montreal, Quebec. Before making Victoria his headquarters, Mr. Hunter was engaged in mining development in the neighborhood of Nelson, in the same province.

Mr. E. Jacobs returned to Victoria at the end of November after an absence of seven weeks, during which period he visited mining camps in East and West Kootenay, Boundary, and Similkameen districts of British Columbia, and afterward spent a few days each in the Coeur d'Alene district of Idaho and at the State College of Washington, Pullman. Among many other mining men he met during his tour were Mr. Douglas C. Livingston, whose first mining connection was on Vancouver Island, and Mr. Francis A. Thomson, whose school days were spent in Victoria. Professor Livingston is now head of the mining engineering department of the University of Idaho, Moscow, Idaho, while Professor Thomson is at the head of the important mining



engineering department of the State College of Washington, where really excellent educational work is being done on an extensive scale.

Mr. A. W. Jenks, of Berkeley, California, has been examining the Carmi mine, situated 50 to 60 miles west of Greenwood, along the Kettle Valley railway between Midway and Penticton.

Mr. Frederic Keffer has been examining the condition of the British Columbia Portland Cement Co.'s cement manufacturing plant near Princeton, Similkameen, B.C., and its shale and limestone deposits in the neighborhood of the works and elsewhere in the district, in the interests of the bondholders, who are endeavoring to arrange for a resumption of cement-making.

Mr. R. A. Lambert has returned to his home in Vancouver, B.C., after having done another season's work at the Golden Gate Syndicate's placer-gold property on Granite creek, a tributary of Tulameen river.

Mr. Douglas Lay, who went to England last spring from the Sloean district of British Columbia after the closing of the Van-Roi mine, of which he had been superintendent for several years, expects to soon obtain a commission in the British army, for active service in the European war.

Mr. Ernest Levy, of Rossland, B.C., manager of the mines of the Le Roi No. 2, Ltd., was an invited guest at the meeting of the Columbia Section of the American Institute of Mining Engineers held at Wallace, Idaho, on November 19-20, and joined in an excursion to the Consolidated Interstate-Callahan Co.'s famous zinc mine and to several concentrating mills at which flotation machines are in successful operation.

Mr. W. R. Rust, of Tacoma, Washington, is reported in Tacoma and Seattle daily newspapers to have severed his connection with American Smelting and Refining Co. and resigned from the presidency of the Tacoma Smelting Co. The resignation is to become effective on January 1, prox. The press despatch says that no reasons are assigned except a desire on Mr. Rust's part to devote his time to the management of personal properties, including gold and copper mines in Alaska, and of the Tacoma Exploration Co., of which he is president. Mr. Rust was one of the pioneers of Alaska development. He built the Tacoma smeltery in 1890. About 1900 he joined forces with the Guggenheims, selling them the smelting works and afterwards leading their invasion of Alaska.

Mr. Roy Wethered, who, following his leaving the employ of the Consolidated Mining and Smelting Co. at one of its mines at Ainsworth, B.C., was in Spokane, Washington, for some time, is now with one of the mining companies operating in the neighborhood of Wallace, Idaho.

Mr. W. R. Hill, of the Capella, a mining property situated near New Denver, B.C., is spending the winter season in Ontario.

Mr. Hugh M. Wolfen, who was in charge of the United States Bureau of Mines' mine-rescue station on the campus of the University of Washington, Seattle, Washington, at the time several British Columbia coal-mine inspectors took the regulation mine-rescue training course there, is to be transferred from San Francisco, California, to the Bureau's chief station at Pittsburgh, Pennsylvania. Mr. Edwin Higgins, also of the Bureau's staff, is stated to have been selected to succeed Mr. Wolfen as engineer to the California Industrial Accident Commission, without, however, severing his official connection with the Bureau. Both officials

are experienced and zealous workers in connection with accident prevention and mine-rescue training.

Mr. Justin S. DeLury, lecturer in geology, University of Manitoba, is expected in Toronto next week.

Mr. B. E. Cartwright is in Toronto.

Mr. S. W. Cohen has been appointed manager of Croesus Gold Mines, Ltd., whose property, the Dobbie-Leyson, in Munro township, is now being developed.

Mr. J. R. L. Starr has been elected president of McKinley-Darragh-Savage Mines of Cobalt, Ltd., succeeding Mr. Justice Masten.

## OBITUARY

William Andrew Conner, of Plainfield, N.J., died suddenly Monday, December 6th, at his office in Perth Amboy, N.J. He was born in Baltimore, September 12th, 1859. He began his business career in 1876, in Pittsburg, in the oil refining business, in which he reached the position of assistant manager for the Standard Oil Co. In 1885 he took charge of the first plant built by the Standard Underground Cable Co. of Canada, Limited, in Hamilton, Canada, and from then to the time of his death he was the head of the manufacturing business of that company, including large plants planned and built by him in Pittsburgh, Pa.; Perth Amboy, N.J.; Oakland, Cal.; and Hamilton, Canada. He was a director for 10 years and first vice-president since 1909. He was vice-president of the Perth Amboy Trust Co., in whose inception he had an active part. He has resided in Plainfield since 1904. He leaves his widow, who was Miss Tupper, of Michigan; a brother, Edward Conner, of Orange, N.J., and a sister, Mrs. Roake, of Brooklyn, N.Y. He was a cousin of Mr. O. T. Waring, of the Standard Oil Co., Mr. E. J. Waring, of the Standard Underground Cable Co., and the late Richard S. Waring.

## DOMES MINES, LTD.

Along with their quarterly dividend checks this month Dome Mines shareholders received a condensed statement of the result of operations for the half year to September 30, as follows:

Earnings—From monthly reports of gold received, \$732,431; recovered from semi-annual mill clean-up, \$60,184; non-operating earnings, \$7,745; total, \$800,360. Less operating and development costs, \$366,458; net earnings, \$433,902.

The dividend charge on Dome is \$800,000 annually, while the above net shows \$867,000 annually.

The balance sheet shows the company especially strong in cash. Included in the assets are cash in bank, general fund, \$411,129; cash in bank fund for special development and improvements, this being the balance of the money realized from the recent issue of 50,000 shares, \$400,358; cash in bank, semi-annual mill clean-up, \$60,184; gold bullion in transit, \$98,575; and accounts receivable, \$6,417.

The only active liabilities shown are \$27,999 payroll, \$26,453 accounts payable, and \$5,729 accrued taxes.

The surplus for the current year to date, after charging \$60,000 for depreciation of plant, is shown at \$573,902, which, added to \$663,598, the surplus from the last fiscal year, makes a total of \$1,037,501, from which the \$200,000 paid in dividends September 1 is deducted, leaving a final balance of \$837,500.

On the basis of increased tonnage and improving ore values in the last half of the year, a profit and loss balance in the next statement of well over \$1,000,000 is indicated.



### BETHLEHEM STEEL.

New York—It is estimated that Bethlehem Steel Corporation is now shipping at the rate of more than 20,000 complete shrapnel shells daily, a new high record.

By the first of next year it would not be surprising if shipments were at the rate of 25,000 shells a day, or 7,500,000 a year.

With additional machinery and plants, and increased efficiency, a production of 10,000,000 shells in 1916 is not out of the question. It is on this expected output that certain steel manufacturers base their estimates of earnings for next year.

Estimates of Bethlehem Steel's earnings in 1916 range between \$300 a share and \$500 a share on the common. If the latter figure is reached, it would mean over \$600 a share for the common in 1915 and 1916, as it has already been established that net earnings for the current year will be in excess of \$100.

Since the middle of the current year there has been a remarkable reduction in cost of producing shells by the Bethlehem Co., which means so much additional profit.

Production has increased each day and there is no telling how large the output will be before the European war ends. It seems certain, however, that earnings on war orders are going to run far in excess of the present market value of the common stock. This is the main reason why Charles M. Schwab and well informed banking interests have invested their money in Bethlehem Steel common. It is figured that these enormous profits will accrue to their benefit in one way or another. If the money is not all disbursed to shareholders, the latter will have their equity in the surplus accumulated or in new plants and acquisitions.

Assuming that no dividends are paid on the common stock in 1916. Bethlehem will have accumulated a surplus in two years that would permit construction of steel plants almost as large as those at Gary.

It is well understood that Schwab has planned an outlay of \$25,000,000 for new construction, to be made up largely of plants designed for manufacture of commercial steel. An expenditure as large as this would still leave a surplus for 1915 and 1916 in excess of \$50,000,000 after liberal charges for depreciation, and it is fair to assume that some sort of a distribution will be made to common shareholders. Whether this will be in the form of a large cash dividend, a stock dividend or both, is a matter to be determined by Mr. Schwab.

Charles M. Schwab's methods are not selfish, and the shareholders of Bethlehem are confident of fair treatment. With most of his war contracts yet to be executed, Mr. Schwab is giving little attention to the question of a capital readjustment or dividends. This is a subject that will be given serious and thorough consideration later on. It may come up when the directors meet early next year to act on preferred dividends.

### CONSOLIDATED MINING AND SMELTING CO. OF CANADA, LIMITED.

Consolidated Mining and Smelting Co. stock was listed on the Toronto Stock Exchange on November 12. As it has been one of the favorite securities on the market, this move has been expected for some time.

The announcement was made to the Exchange authorities that a new issue of stock had been made amounting to 11,611 shares of treasury stock. On November 12 the shareholders were mailed the right to take this stock at par in the proportion of one new share for every five held by them. The new issue leaves

\$533,700 of the \$7,500,000 authorized capital still in the treasury. This new distribution acts as a small bonus to shareholders, because on the current market value of the stock they will profit by the rights by between \$7 and \$8 a share. The purpose of the new issue has not been disclosed, but the proceeds will probably be devoted to equipment for recovering zinc.

The company, which has been working out a new process for treating zinc ores, has, it is stated, demonstrated that it can successfully recover the zinc. As a result the huge quantity of zinc ore that has been accumulating for a long time will now be treated. This will add greatly to the assets of the company.

The complete figures of the company's last fiscal year's operations have, it is understood, been passed on by the directors, and were fully up to expectations. The annual meeting has been called for the third week in December; the annual report will not be available until that time.

### INSTITUTIONS AND THE WAR.

In the cases of certain of the technical institutions the membership figures show no increase since the war, the reason being that these institutions and their members are not particularly associated with war-work. Members, therefore, in such cases, join the fighting forces in large numbers as the best way of serving their country. Though about ten per cent. of the Institute of Metals membership has been temporarily lost in this way most of the members are now assisting the country by working "on munitions." The war activity in the metal industries is such as to tend strongly to reinforce the membership of the Institute. It is probably due to their desire to see and to study the volumes of the Journal of the Institute of Metals that so many new members are joining the Institute of Metals just now. They cannot readily get away to meetings of the Institute in war time, but they find all the papers that were read at the meetings recorded in the invaluable transactions, along with much additional information respecting the use and working of the non-ferrous metals and alloys.

### STEEL CO. OF CANADA.

The Steel Company of Canada as a result of its increasing business, largely due to the big war orders it has received and the prospect for business after peace is arranged, is planning extensive additions to its plant. Three new open hearth furnaces are to be built at once, the blooming mill extended and two force shops erected for the manufacture of 8 and 9.2 shells. The improvements will cost several hundred thousands of dollars.

### CANADIAN COAL AND COKE.

A despatch from Calgary, Alberta, announced that the largest foreclosure action ever taken in Western Canada had been commenced in the Supreme Court at Calgary. The Royal Trust Company, on behalf of the bondholders is asking for judgment for \$3,000,000 against the Canadian Coal and Coke company. The Financial Times understands that this foreclosure proceeding is preliminary to the proposed re-organization.

### SENECA-SUPERIOR DIVIDENDS.

The issued capital stock of this company is \$478,884, and the dividends paid to date, together with that declared payable Dec. 15, makes a total of \$981,212.20 or 205 per cent.



## SPECIAL CORRESPONDENCE

### BRITISH COLUMBIA

There is little change in the mining situation in the Province, except that in the placer-mining camps cold weather has compelled a cessation of gravel-washing and that in a few instances snow interferes with the operation of small mines, generally those at which there is danger of snowslides that make it unsafe to use trails while there is the risk of snow coming down at any time. Reports from the larger producing mines indicate that the output of ore is being well maintained and that the year's total of production will be fully as large as can be expected under conditions some of which have militated against the year proving as prosperous as would have been the case had there not been adverse conditions to affect the output of several of the mines in the first half of the year.

#### Cariboo

The placer-mining season closed in this district about the end of October. In the early spring the prospects for a sufficient water supply to admit of piping being continued until nearly the end of autumn were unfavorable, for the snowfall during the previous winter had been less than one-half of that of ordinary winters. However, summer and autumn rains were frequent and the result was that it was found practicable to continue hydraulicking until the near approach of winter. The placer mines operated were those known as the John Hopp properties, situated on Lowhee creek, Stout's gulch, and Mosquito creek; that of the Lightning Creek Hydraulic Mining Co., on Lightning Creek; and on Perkins gulch, Chisholm creek, Shepherd creek, China creek, and Slough creek, all in Cariboo mining division of Cariboo district. In addition much work was done in different parts of the division with Keystone drills, with the object of ascertaining as far as could be done by this means the average gold content of gravel beds which it is thought might be profitably dredged. Not much progress appears to have been made toward further developing a number of quartz properties on which work had been done intermittently over a long series of years, as yet, though, without production commercially being established.

#### East Kootenay

Ore production at the Sullivan mine during five weeks ended November 25 was not up to the average of the previous sixteen weeks of the second half of the year, having been only 3,973 tons for the first-mentioned period, an average of about 795 tons a week as compared with 954 tons. However, there was an increase for the week ended November 25, the output having been 1,103 tons. The total quantity of Sullivan lead ore received at the smeltery at Trail during 47 weeks ended November 25 was 40,909 tons, against 36,784 tons for the whole of 1914. It now appears doubtful if the increase for the calendar year 1915 over that of 1914 will be more than 9,000 or 10,000 tons, or only one-half of the estimated increase as published in the Journal last month.

It is reported that a number of coal miners who had for some time been unemployed on Vancouver Island have been engaged to work in Crowsnest Pass coal mines. The total number of men from the coal mines of the latter district who enlisted for service in the

European war has been placed at more than 500. If so comparatively large a number went from Crowsnest mines, it is not surprising that it has been found advisable to obtain miners from other parts.

#### West Kootenay

**Ainsworth**—It is reported that ore has been struck in a raise in the Gallagher mine, owned by Mr. A. D. Wheeler and being developed by Messrs. Beckett of Spokane, Wash. Announcement has been made that Mr. A. W. McCune, of Salt Lake City, Utah, has arranged for work to be done throughout the winter on a group of mineral claims in Ainsworth camp. Shipment of silver-lead ore from the No. 1 mine is being continued; the published figures of ore receipts at the Trail smeltery from this mine indicate an average output during six weeks ended November 25 of 147 tons a week. Although there has not been any production from the Highland mine this year, it is known that a good shoot of ore has been opened at a lower level than that on which ore was stoped before the commencement of the war and while the Highland concentrating mill was in operation up to the middle of the summer of 1915.

Interest in mining in the region of the South Fork of Kaslo creek is greater now than for several past years. It is regretted that owing to the insufficiency of the water supply the Cork-Provence concentrating mill has been closed for the winter, but when the new water line is completed this obstacle to continuous operation will have been removed. The mining and concentration work of the 1915 season has demonstrated to the local company concerned that its undertaking can be continued with profitable results, so that the outlook is favorable for the prosecution of this enterprise with new vigor next spring. The bonding of the Martin group with option of purchase has been followed by inquiries for other properties in the neighborhood, and negotiations have been in progress for the sale of the Granite and Gray Eagle claims, situated near the Flint mine, and for another South Fork property known as the Gibson group.

Woodbury creek, also in Ainsworth division, is now having the attention of Mr. Chas. F. Caldwell of Kaslo, who was most persistent in his efforts to interest others in the Utica mine, on Paddy mountain, until he succeeded in placing it on a basis that ensured its being regularly operated. The Kaslo "Kootenian" states that Mr. Caldwell has succeeded in making arrangements for the consolidation of a number of mining properties on Woodbury creek, and quotes Mr. Caldwell, in part, as follows: For years the mining properties of Woodbury creek region have lain idle because the prevalent ore of the district proved to be zinc and lead instead of lead only, as was indicated by the surface outcrops. . . . With the recent extraordinary demand for zinc and the relatively high price it now brings in comparison with lead, attention has been turned to the Woodbury district. . . . I have succeeded in consolidating large holdings in that part and I now control 14 claims. . . . In developing the properties I shall be guided by the counsel of Mr. W. Yolen Williams, formerly in charge of the Granby Co.'s mines at Phoenix, Boundary district. The development work contemplated will consist of drifting 2,000 to 3,000 ft. north on the ledge and a similar distance south, which



will give a vertical depth of approximately 1,000 ft. at each face. Judging from surface indications this development should open orebodies that should give us many years' ore reserves. . . . Assays taken from the different shafts, tunnels, and surface showings on the vein for two miles have given 50 to 57 per cent. zinc and about \$10 to the ton in gold and silver, while the lead ores run 70 to 75 per cent. lead and also contain \$2 in gold and 60 to 70 oz. silver to the ton.

**Slocan.**—Reports from the Lucky Jim mine are to the effect that with about a dozen men employed stopping, etc., an output of some 60 tons of ore a day is being maintained. The ore is shipped to the custom concentrating mill at Rosebery operated by Mr. J. P. Keame; a larger quantity will be milled daily as soon as the output of the mine shall be increased. Shipments of zinc concentrate from the mill to Kansas was commenced last month. Early in November ore was cut on the 912-ft. level of the Payne mine; a published report gives the width of the oreshoot as 2 ft. 6 in. and states that it contains lead and zinc in about equal proportions. A crosscut adit had been driven about 3,600 ft., this constituting what is known as the 1,500-ft. level, and a raise was made thence to the old 800-ft. level. Afterward a level was opened at 112 ft. below the old bottom level, and it was in driving to get under a winze sunk 34 ft. from the 800, and in which there was 2 ft. of ore, that the new find was made.

Between 3,000 and 4,000 tons of zinc concentrate has been shipped in recent months to United States reduction works from the Standard Silver-Lead Mining Co.'s concentrating mill at Silverton. Since shipment of silver-lead ore and concentrate was resumed last July approximately 4,000 tons of these products has been received at Trail from the Standard. Production has been commenced at the Galena Farm mine, situated a mile or two south from Silverton, and lead and zinc concentrates are being produced at the mill there. Another car of ore has been shipped to Trail from the Lucky Thought mine, on Four-mile creek, near Silverton; this property is being developed, under option of purchase, by the Consolidated Mining and Smelting Co. Several weeks ago it was reported that a strike of high-grade ore had been made on the Black Grouse claim, up the North Fork of Carpenter creek; recently a shipment of 11 tons of ore was made to Trail from that property, but no information has yet been received relative to its metal contents.

**Nelson.**—Additions to equipment at the Relief mill, in Erie camp, include a Dorr duplex classifier, a tubemill 4 by 20 ft., a cyanide plant, and an 80-h.p. steam boiler as an auxiliary to the water-power hitherto used to drive the mill machinery. The treatment capacity of the stamp mill and gold-saving plant has been increased to 50 tons per diem. Mine equipment has also been added to. A raise from No. 4 level now connects with No. 3. Five stopes have been opened from No. 4 and two shifts are working in the mine.

The Jewel gold mine, in Boundary district, has been leased. The Skylarks, also in Greenwood mining division, is being worked under lease by local men who have been taking out ore. The Sally, near Beaverdell, West Fork of Kettle river, is again a shipper, with two lots of leasers at work taking out ore. The Carmi has lately been examined by an engineer sent in by prospective buyers resident in the United States.

In Similkameen valley, the Horn Silver is making an occasional carload shipment of ore of good grade. The discovery of molybdenite ore on claims in Olalla camp, Similkameen, is reported.

Three men have been employed since last July doing development work on the McKay group, on Adams river, in the northern part of Vancouver Island. A drift is being run on a showing of copper-gold ore, and it is intended to work throughout the winter unless prevented by too much water in the adit. The property is distant about 15 miles from tidewater on the eastern side of the island, and 25 miles from Quatsino on the western side. The work is being done under the direction of Mr. J. Cleveland Haas, of Spokane, Wash., for a syndicate of residents in that city.

## NOVA SCOTIA

**Dominion Coal Outputs**—The output of the Glace Bay mines for November totaled \$428,000 tons, showing an increase over the outputs of last November of no less than 132,000 tons. Nevertheless, the production was restricted by shortage of men to the extent of probably between 70,000 and 80,000 tons. December outputs will probably reach 400,000 tons, compared with 282,000 tons last year. If this is the case, the production for the year from the Glace Bay mines will reach 4,600,000 tons, or about 315,000 tons in excess of 1914 figures, and within 140,000 tons of the record production of 1913. The six months beginning October, 1914, and ending March 31st, 1915, was a very lean period, so far as coal production is concerned, so that comparisons with present rates of production show greatly to the advantage of the current period. It must not, however, be assumed that the mines are doing well when compared with previous output records. In the corresponding period of last year, outputs were restricted by lack of demand to about half production. At the present time the mines are working to the full capacity of the present force of workmen, yet the daily outputs are about 4,000 tons below normal full production.

## COBALT

The remarkable briskness of the interest in the silver mines and prospects has already had much influence on the Cobalt camp. There are numerous inquiries for silver prospects and the market for shares of silver-producing companies has been even more active than of gold. In this advance there is something more than speculative value for every cent. advance in the price of silver is so much more profit to every mine producing. While ore shipments have shown a marked tendency to increase, such is the belief that silver will go much higher that shipments are not being rushed. However, those companies who were storing their silver in the confident belief of better days are now shipping at a normal rate, but no more than a normal rate.

**Coniagas.**—The news that the Coniagas Mining company has purchased the old Agaunico Cobalt mine on Lake Timiskaming is of more importance as a reminder of one of the old discoveries of the district than of any real importance. The Timiskaming-Cobalt, as it was first known, was owned by Professor Van Hise and other American geologists. While it was in their possession they shipped some 88 tons of ore. This ore ran very high in Cobalt, but only a few ounces in silver. Later in the midst of the silver boom at Cobalt, a syn-



dicate of Chicago men bought the claims and named them the Agaunico mines. Very little mining was done and no shipments made, but the claims were widely misrepresented all over Canada and the United States. As a result the shares were sold all up and down the country. The property stands on the shore of Lake Timiskaming and is now the centre of a very successful dairy farm. There is still in place at the 50-foot level a vein of cobalt ore about a foot wide. At lower levels the vein was strong, but did not contain as much cobalt. Very little attempt was made to pick it up in cross-cutting or drifting. It may be that the management of the Coniagas intend to mine and ship the cobalt ore, as there is now a steady market for the same; but it is much more likely that an effort will be made to discover better silver values by systematic development. The mine is not more than half a mile away from and is in the same formation as the Green-Meehan mine, where some remarkable blocks of high grade were taken out in the early days of the camp.

**Ophir.**—It is also reported that the Ophir-Cobalt will be started up again soon by the company itself. Short shoots of silver were found on the Ophir from time to time when it was developed, but development money ran out before enough of it could be blocked out to make profitable shipments.

**Seneca-Superior.**—A remarkable record for low costs is being made by the Seneca-Superior Mines. The following figures speak for themselves:

The operating costs for the past five months are as follows:

	Per ounce.	Per ton.
June. . . . .	.096	\$4.25
July. . . . .	.069	3.05
August. . . . .	.063	3.07
September. . . . .	.048	3.36
October. . . . .	.048	3.55

The dividend record of the company to December 15th, when the next disbursement is made, shows that there will have been distributed more than double their issued capital of \$478,884. The dividend record is as follows:

Dividends paid.	Total.
1913. . . . .	\$310,774.60
1914. . . . .	335,218.80
1915. . . . .	239,442.00
December 15th, 1915. . . . .	95,776.80
	<hr/>
	\$981,212.20

The cash on hand on November 20th was \$180,000. In addition, payment has just been received for two cars amounting to \$59,510.65, thus making a real cash balance of about \$240,000 on or about November 26th.

**Cobalt Comet.**—The new vein found on the Cobalt Comet is proving up very well. This vein is about 200 ft. north of the house the late Dr. Drummond lived in

when he was in the Cobalt camp. A shaft has been sunk on it and it has also been cut underground. As already described in the Canadian Mining Journal the vein was of solid niccolite and smaltite when first discovered in trenching and it was fully 10 inches wide. This solid vein carried several ounces in silver. At a depth of 20 ft., the character of the vein changed to the characteristic high grade silver-smaltite ore of the camp, running from four to five thousand ounces in silver. This shaft will be continued down and connection made from the cross-cut from the old workings. It is estimated that there should be an average of about 50 ft. of conglomerate along the 200 ft. of the vein. To the south the vein has been stripped for some distance and there are patches of very remarkable high grade silver ore. The ore is already being sacked. In other places in the old workings of the Comet the Kerr Lake management has met with good success. The Blue Jay vein is developing some tonnage of good milling rock and there are also short shoots of high grade. On the Hargraves boundary, from a winze in the Keewatin three tons of high grade ore has been mined and shipped. Since the beginning of the present month the shipping of mill rock from the Comet to the Dominion Reduction has been resumed.

**Alexandra.**—Mr. Sydney Smith and associates are running a drill on the old Alexandra under lease. This property adjoins the Bailey mine and it is hoped to pick up the Big Pete vein. Some years ago an ambitious scheme of development was outlined and a shaft carried to the 300 ft. level, but nothing of importance was found.

**Foster.**—From the Glen Lake Silver Mines, who are working the old Foster under lease, there has been shipped three tons of high grade ore to Messrs. Campbell and Deyell. This ore was taken from near the boundary of the Lawson. The main scheme of development on the Glen Lake is proceeding under the lake, the hope being that continuation of the ore shoots being mined by the Penn-Canadian or the Bailey will be found.

**Chambers-Ferland.**—Some high grade ore has been found in a winze down to about 400 ft. from the Chambers-Ferland. This winze was sunk near the Nipissing line on a strong vein of niccolite and smaltite with a low silver content. This vein dipped out of the winze but when the winze was continued down vertically another vein was cut. It is but narrow and much broken up, but it is of high grade ore.

**Poste.**—An interesting discovery of native silver in galena has been made on the Poste claim in Morissette township near the three-mile post. It is about four and a half miles from the Tough-Oakes mine. There are quite large flakes of native silver in the quartz and it is understood there are fair values in gold.

**Kerr Lake.**—Pumping in order to still further lower the mud in Kerr Lake has ceased and will not be resumed. The scow on which the pumps are mounted has been moved to dry land and will now be a permanent installation. It will be used only for pumping out the surface water which makes its way into the basin of the lake.

**Silver Leaf.**—In a car shipped to the Coniagas Reduction Co. there was contained 45,000 ounces from the Silver Leaf. This was of high grade ore mined some time ago under lease of the Crown Reserve.

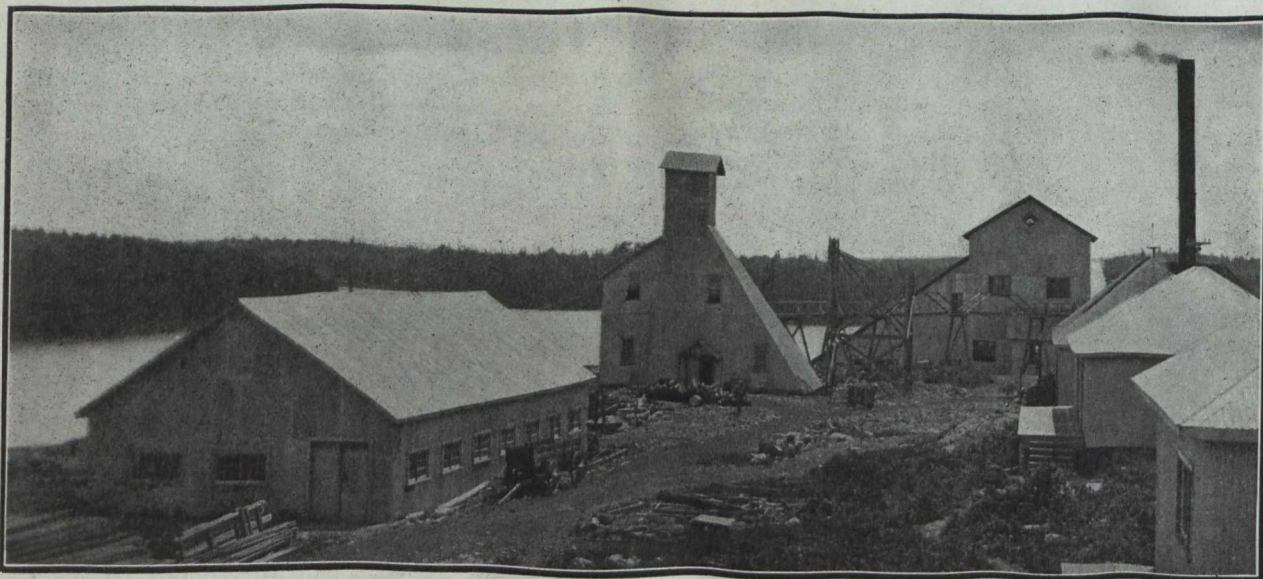


## PORCUPINE, KIRKLAND LAKE, MUNRO TOWNSHIP and BOSTON CREEK

**Croesus.**—Although some difficulty has been experienced with faulting on the 100 ft. level of the Croesus Gold Mines in Munro township, there has already been developed an ore shoot of about 140 ft. on the 100 ft. level. The vein will run from six inches to two or three feet wide. There are occasional patches of the high grade ore which made the Dobie-Leyson property so famous earlier in the year, but the average grade across a stoping width is remarkable. Below the 100 ft. level the shaft was out of ore. The sub-level was good at 150 ft. and it is understood that the vein has been cut here. The incline shaft is now down close to the 200-ft. level, and it is confidently expected that with past experience in picking up the vein there will be no great difficulty in finding it at that depth.

of ore have been drilled and a few feet beyond the marked success has been obtained with the use of metal balls in the tube mills in the place of stone pebbles. It is estimated that when these balls are being used in all the tube mills that it will be possible to treat 300 more tons a day with the present equipment. This will mean that when the improvements inaugurated in the present mill are completed that it will be treating 700 more tons per day.

**The Porcupine Vipond** has cut its vein at the 500-ft. level. In the winze it shows as yet as a stringer of quartz, very rich, but quite narrow. A drift will at once be commenced on it. While the production at the Vipond continues to be rather low the development at the mine is most satisfactory. Development and stoping at the 300-ft. level particularly, has discovered reserves of ore which it was not at all anticipated



SWASTIKA MINE, ONTARIO. RECENTLY RE-OPENED

**Munro Consolidated.**—Since the hard weather came and the road has been passable, development on several nearby prospects has been resumed with great vigor. A discovery of some importance has been made on the old Leyson property, which is now incorporated under the title of the Munro Consolidated mines. Before the snow came two prospectors had located good veins in Bowman township, not far from the town of Matheson. These have been a little more prospected since and there is at least one free gold discovery of promise.

**Hollinger.**—The surface improvements on the Hollinger are now rapidly approaching completion. The most important of these from the mining point of view is the new head frame which will be of proportions not before attained at any mine in the North Country. The masonry upon which the head frame will be erected has been completed and the tender for the head frame has been let to the Dominion Bridge Co. But from the point of view of the ordinary passer-by the new office building is the more prominent. The structure of this building has now been completed. The directors' bungalow on the hill is also now roofed in and the main structure completed. It has also been found necessary to build a new transformer house. The new transformer is being built between the old office and the mill.

In the Hollinger mill itself, after some months' trial,

would be found. Veins that were believed to be out point where development had been stopped, the vein has been picked up again much stronger and richer. It is now believed that at the lower levels the two main systems on the Davidson and the Godfrey will merge into one, since, as each successive level has been opened up, the gap of barren ground between these ore-bodies has steadily decreased.

**McIntyre.**—Development at the No. 5 shaft on the McIntyre continues to give lively satisfaction to the management. About 70 ft. to the south of the No. 5 shaft the Contact vein has been cut. It is between four and five feet wide and ore running between \$10 and \$11 to the ton. On the same orebody on the 600 ft. level drifting has been in progress for some time both ways. To the north the diamond drill is working and has picked up the No. 5 vein on lower levels.

The dewatering of the Jupiter shaft has commenced. It is believed that it will take about two weeks before the workings will be free of water and actual mining can commence. A rock-house will be established at the Jupiter and from it the ore will be teamed to the McIntyre mill, where it will be treated at a cost to the McIntyre-Jupiter mines of \$2.00 a ton. A crosscut from the main shaft of the McIntyre will also be started along the Contact vein in the Jupiter ground at once.



The Pearl Lake shaft is now down to about 900 ft. Every effort will be made to put it down as fast as possible as it is to be used as the main working shaft of the McIntyre group. The structure of the addition to the McIntyre mill is now completed, but delivery of machinery may delay the time when it will be available for operation.

**The Smith-La Bine claims** at Sesekinika have been taken under a working option by Mr. Robert Livermore, manager of the Kerr Lake Mining Co. Work has already been commenced on them. Throughout the summer these claims have been sampled from time to time and always with satisfactory results. But there has always intervened to prevent the consummation of the deal, some undesirable factor. There is now little possibility that these promising claims will not receive adequate development.

**Kirkland Lake.**—A large amount of machinery is now being hauled over the winter road from Swastika to Kirkland Lake. This machinery is going to the Teek-Hughes property at Kirkland Lake and the La Belle gold mines at Good Fish. As soon as it has been installed more stimulus will be given to the underground operations of these two properties.

There has never since the early days of the Kirkland Lake rush been so much activity as now exists in this section of the Northern gold fields. There is an excellent demand for claims upon which gold has been discovered and which are within reasonable distance of producing mines.

## NEWFOUNDLAND

**Iron and Steel.**—The transportation of iron ore from the mines at Bell Island to Sydney was discontinued about Dec. 1st, and shipping will not be resumed before April next. The amount of ore shipped from Bell Island to Sydney since the opening of navigation last spring was 600,000 tons. In addition to this several cargoes went to England and the States. Operations during the past season were most successful both industrially and financially. Though shipping of ore has ceased until next spring, there will be no let up at the mines. Both companies are working day and night and intend doing so all through the winter months, employing the largest possible number of men.

In conjunction with the mines at Bell Island, a large staff of workmen are working day and night on additional new open hearth furnaces at their Sydney smelting works. In order that the Dominion Iron and Steel Co., whose steel plant is at Sydney, may be in position to reap a large portion of the recent eight million dollar order for munitions given by the British Government, it was found necessary to increase their plant by additional blast furnaces. In the work of excavation for this work a record was made, and from data in my possession I am in a position to state that one of these furnaces will be the largest and most modern ever built, and will be finished and ready for operation in a shorter time than was formerly thought the work could be done. This furnace will turn out a particular steel for the manufacture of eight, nine and twelve inch shells, and larger if required. This furnace alone will have a capacity of over 200 tons per day. Last month the steel shipments from Sydney were the largest ever made, doubling the shipments of the previous month; but notwithstanding this large output unfilled orders

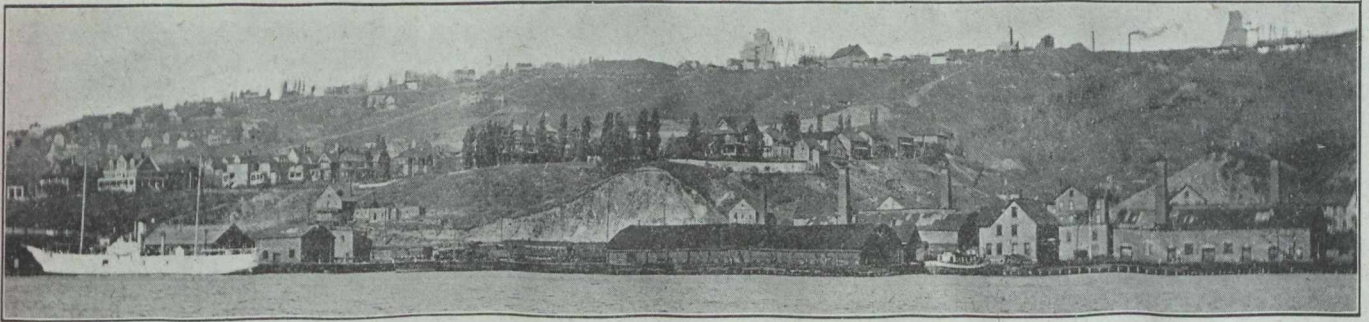
to the amount of 180,000 tons were obliged to remain over for this month. Every effort has been put forth by the Dominion Iron & Steel Co. and the Nova Scotia Steel Co. to keep pace with the increasing orders. Large numbers of the best available skilled mechanics have been added to the staff, and hundreds of miners and ordinary laborers have been added to the pay rolls, but still it was impossible to fill the orders. On the whole the outlook for the industrial workers in connection with the smelting and mining works at Sydney and Bell Island, Nfld., could not be brighter.

**Copper.**—Work on the different copper mines throughout the Island goes on steadily, and the output increases. Mr. MacKay's Syndicate, capitalized at \$100,000, and known as the Hydro-Electric Smelting Co., has completed all arrangements for the erection of a copper smelter, on the south side of the harbor of St. John's. The company has purchased from Mathieson & Co., of London, the old copper mine at Little Bay in Twillingate district. The immense deposits of copper waste which were piled up during the years this mine was working, containing several hundred thousand tons, and considered in those days not worth handling, will at once be utilized by the company, and used to feed the smelter, and will thus be turned into commercial value. When this mine was in operation, 35 years ago, only the very best ore was shipped from there to Swansea, so that large piles of ore containing a great percentage of copper were thrown aside into waste dumps, which will now be used to considerable advantage. In the neighborhood of this mine is a large lake, into which thousands of tons of copper waste was thrown and the drainings from copper heaps thrown around have been flowing into this lake for years. Scrap iron taken from the water is found to contain thick coatings of copper. The Little Bay mine was worked very successfully and with considerable gains when copper was worth only seven cents per pound, so that the present owners may reasonably expect very profitable returns when copper is quoted at 20 cents per pound.

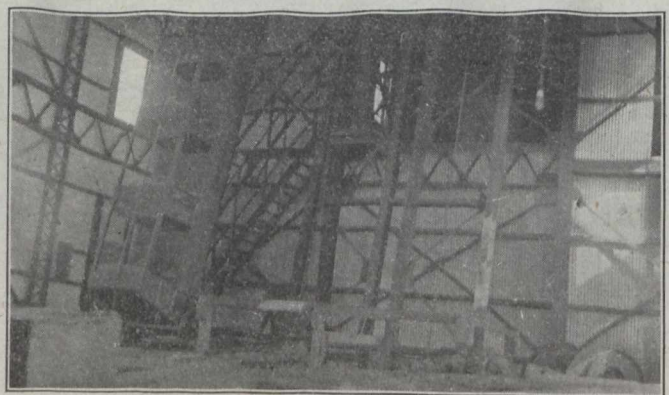
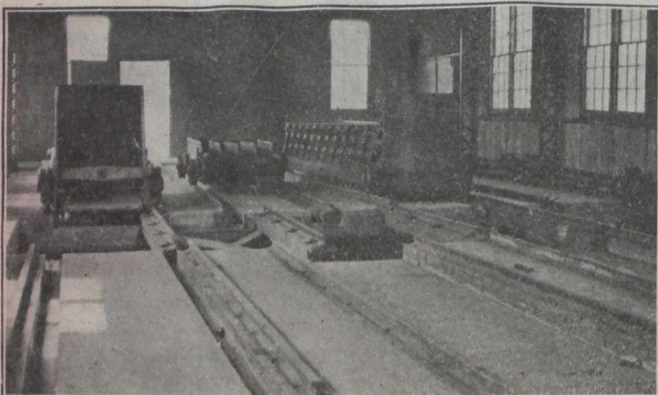
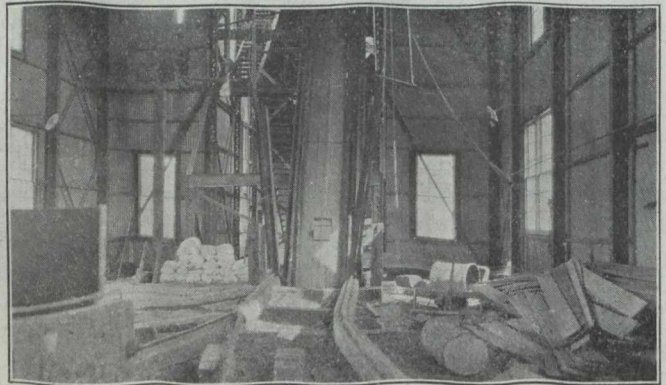
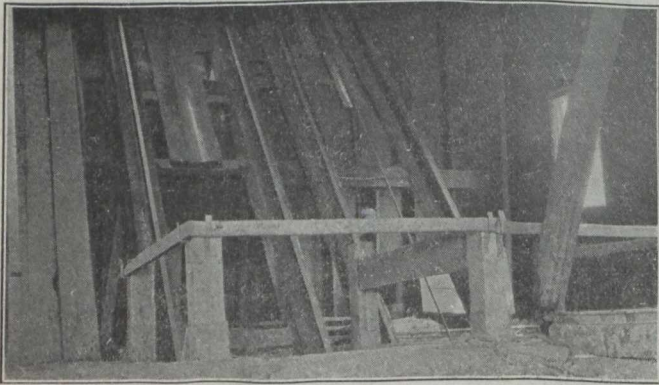
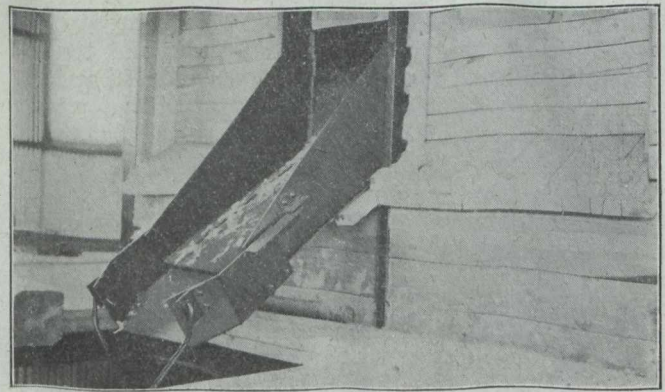
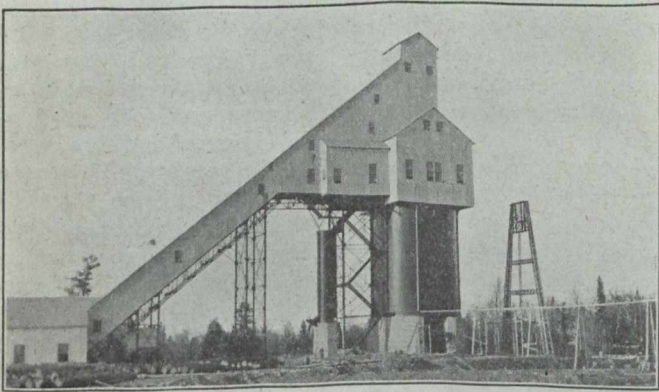
**The Newfoundland Shell Co., Ltd.** hope to be able to begin manufacturing shells at the beginning of the New Year. The capital stock of the company has been fully secured to the shareholders by Government guarantee. The par value of the shares is \$50 each, and there remain only 500 more shares for subscription which will no doubt be all taken up during the week. The company is under contract with the Canadian Steel Committee to manufacture shells for the Imperial Government, and under terms which assure very profitable returns. It is pleasing to note that the copper and steel to be used in the making of these shells will be produced from the mines of Newfoundland, the copper being smelted here and the steel a product of the iron mines of Bell Island, which will be smelted and manufactured at Sydney, C.B.

**Lead.**—Very pleasing intelligence has been received of the formation of a company in Boston, Mass., for the purpose of working some of the fine galena deposits situated at Port-au-Port in the district of St. George's, west coast of Newfoundland. In many of the reports issued from time to time by the directors of the Geological Survey, will be found very hopeful references to the possibility of this country containing large deposits of lead and silver. The deposits now about to be worked, in the district of St. George's, give as high as 84% of lead, with little or no silver.





QUINCY HILL, HOUGHTON, CO., MICHIGAN



ROCK-HOUSE SUGGESTIONS FROM MICHIGAN MINES



**COPPER TO SWITZERLAND.**

Shipments of copper and other materials have been resumed to Switzerland, after being long cut off by the Entente powers, under an arrangement similar to the plan of the Netherlands Overseas Trust in Holland. A concern known as "S. S. S., Swiss Surveillance Society," translated, has been organized under Government supervision and guarantees given that shipments consigned to it will remain in Switzerland. Plan became operative on Dec. 1, and already small shipments of copper have gone forward under this arrangement.

**MICHIGAN COPPER OUTPUT.**

Houghton, Mich., Dec. 3.—The Lake Superior copper mines produced over 25,000,000 pounds of refined cop-

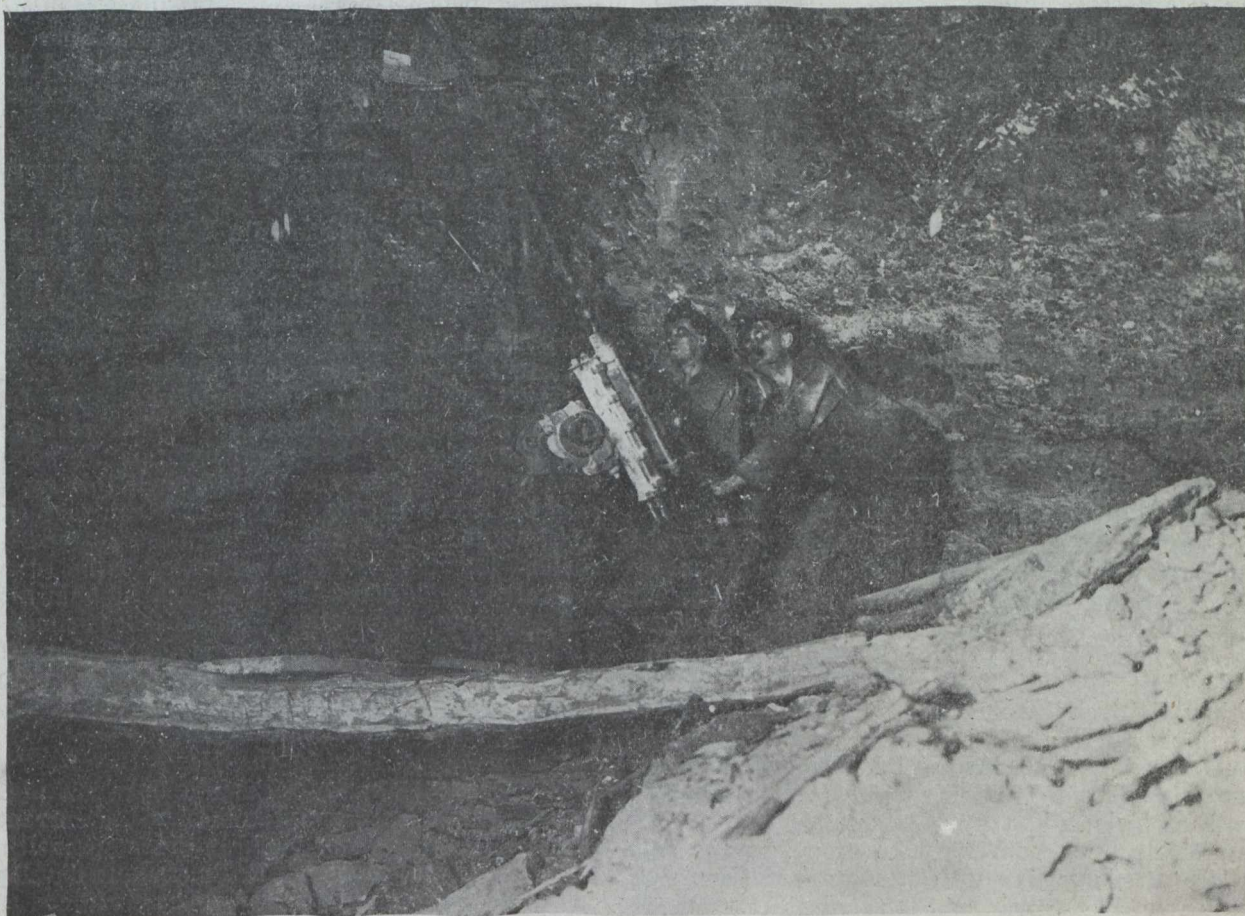
\$55 per share, and the principal subsidiary \$5,500,000, the Calumet equity in which. This makes a total of \$7,750,000, which Calumet & Hecla. The company will have paid \$50 per share in dividends in 1915.

**THE TUNNELING COMPANY.**

Newspapers of Alberta and British Columbia recently published a notice sent out from Calgary, Alberta, as follows:

"Recruiting for No. 2 tunneling company of engineers, Canadian expeditionary force, will be started immediately with Calgary as the mobilization point.

"Miners and mine workers will largely compose this specialized unit, as a knowledge of tunneling in all



Mining Copper Ore, 68th level, Calumet and Hecla mines, Michigan

per in November. Ahmeek and Osceola showed the largest increase in output, the latter breaking all records, sending 101,000 tons of rock to the mill. Osceola's increase came from South Kearsarge, that branch alone running as high as eighty cars daily. Wolverine showed a small decrease.

**CALUMET AND HECLA.**

According to the Boston News Bureau Calumet & Hecla will produce in 1915 about 65,000,000 pounds of copper, the best showing in three years. With its rock running 22 pounds of refined to the ton the cost may be estimated at 9½ cents per pound. In 1912, with production of 67,000,000 pounds and rock averaging 24.1 pounds per ton, cost was 9.86 cents, with the fraction representing construction expenditures.

On a basis of 18-cent copper Calumet & Hecla will earn about \$5,500,000 from its own operations, or say

grounds, mining, timbering and the handling and laying of high explosive charges will be essential in those desiring to join. Various mining centres of Western Canada will therefore be visited and asked to contribute their quota.

"Major R. W. Coulthard, who is a mining engineer of 15 years' standing in Western Canada, will organize and command the company, which is a departure from previous military establishments in Canada and has been inaugurated to meet certain exigencies and requirements which have developed at the front.

"Further particulars, concerning the recruiting itinerary, Calgary recruiting station address and establishment generally will be announced in a few days. Written applications for enlistment may be made to Major R. W. Coulthard at post-office box 2317, Calgary, Alta. It is expected that this force will leave for overseas very soon after organization has been completed."



## CITIZEN BLACK

tion the Post-Intelligencer, published in Seattle, State of Washington, on November 28 printed, among its editorials the following comment:

George Black, Governor of the British territory of the Yukon, concerned on the King's civil business on the outskirts of the Empire, felt that his country needed him more for defence than for civil government, so a few days ago he wired his resignation as Governor to Premier Borden of Canada, and will put on his uniform as a captain in the territorial forces and go to the front of war, in France. Men of the North, of Alaska and of the Yukon, who have known Black for so many years, will feel a thrill of pride in their friend's patriotic performance.

Long ago George Black showed his quality of manhood as one of the host of courageous, persistent men who braved the dangers and discomforts of the northern wilderness to establish civilization there. It is a democracy with no rank but manhood, and Black's title to membership was unquestioned. When deserved honor came to him the host of his fellow-pioneers were proud of his recognition. Now, when he has accomplished his reward and is secure in the fruits of his labor, at a time when his age would relieve him of military service, he lays down the honor of civil position to defend his country with his life, if need be.

It is a fine, a particularly fine and manly thing that George Black, man, Governor and soldier, has accomplished, and it will find recognition in a company not cribbed, cabined and confined by national boundaries—the great company of the manhood of all nations.

### FIRE AT DRUMMOND MINE, N. S.

New Glasgow, N. S., Nov. 29.—Fire in the Drummond mine at Westville was discovered at 4 o'clock Sunday morning by Calder Russell and Fac. Smith, who had gone down to feed the horses, says the News. They encountered smoke at No. 13 lift. They tried to locate the fire and at 18 South level about 125 feet from the slope they discovered a door ablaze. They hastily returned to the surface and had an emergency call sent out for General Manager Maxwell, Mechanical Superintendent Richardson, Mine Manager Henderson and some other officials.

The officials went into the mine as quickly as possible. The first question which confronted them was as to whether the fire was concentrated at 18 south, or whether it extended to other parts or throughout the mine as well. Messrs. Maxwell and Henderson worked down below the fire into 19 but could not proceed any distance into the levels north or south owing to the heavy smoke.

The officials of the Acadia Coal Company having learned of the trouble in Westville, hurried to the scene of the trouble and rendered valuable assistance. The Draeger men were summoned and were gotten below as quickly as possible. They were able to penetrate the levels at 19 and found fire north and south.

With this information to work on General Manager Maxwell decided the best thing to do was to seal the mine. A stopping was built below No. 9, and the tunnel connecting Nos. 1 and 2 seams in the vicinity of No. 9 level was also sealed up. After this work had been accomplished all surface entrances to the mine at the main seam, second seam and No. 4 were sealed up and the fan stopped.

No lives were lost, but thirteen horses which were in the mine were lost. The horses in the Scott Pit and No. 4 were removed.

The cause of the fire is a mystery. Men were working in the vicinity of the fire on the night before and everything was safe within a few hours previous to the discovery, and it seems impossible that it could have resulted from spontaneous combustion. There are evidences on the slope between 17 and 18 which go to show that there was a slight explosion and it is supposed that this scattered the fire. The bells in the winding engine house rang about 3.30 for no apparent reason, and it is supposed that the explosion occurred at that time.

Various theories are offered as to the cause of the fire, and some of the miners around town hint at foul play. As a matter of fact nothing is as yet really known.

The town water has been turned into the mine, and the intention is to flood the fire district as speedily as possible. The whole Drummond Colliery is likely, however, to be shut down for some weeks to come.

Mr. Fergie, president of the company, and Mr. Patterson, vice-president, are expected to arrive from Montreal to-night.—Sydney Post.

### CANADA FOUNDRY & FORGINGS, LTD.

New York—An officer of one of the large steel and iron companies in the middle West recently made an inspection of the plants of Canada Forge Co. and Canadian Billings and Spencer Co. at Welland, Ont. Both these companies are owned by Canada Foundries & Forgings, Ltd., and it is believed in certain quarters that the inspection may lead to change in control of corporation. Canada Foundries & Forgings, Ltd., has received two new contracts for shell forgings, which will necessitate further plant extension. Company is now turning out complete steel shell forgings at the rate of 12,000 per day. One new contract calls for 3,000 six-inch shells a day. The other is for 30-pound shells. Earnings are now estimated to be running at the rate of \$200,000 a month, which is equal to almost 250% a year on outstanding \$960,000 common stock. A large dividend distribution is looked for after the close of this year.

### ANACONDA.

Boston—According to the News Bureau the Anaconda Copper Mining Co. is not only making sensational recoveries of metal values in the current flotation treatment of its ores and in the later smelting process, but it has also made equally striking developments in the leaching of its tailings. These tailings are now being leached with a loss of only 3½ pounds of copper per ton.

It is quite probable that soon after the first of the year President Ryan will address a statement to shareholders outlining in careful detail the extraordinary achievements of the past year or two in the company's metallurgical department. He may also say something concerning the company's big low grade copper property in South America and make reference to its entrance into the field of spelter production.

### CANADIAN MINING AND EXPLORATION.

Directors of Canadian Mining & Exploration Co. have proved liquidation of the company. Assets of the company have all been liquidated. On receipt of proxy stockholders will receive their original investment in cash.

In addition to this it is expected liquidation will net stockholders between 5% and 7% per annum. Company has been in existence since May, 1912. On a basis of 5% a year, this would mean about 17½% above the original investment.



**MR. SCHWAB TALKS AT PITTSBURGH.**

Chas. M. Schwab in Pittsburgh last Wednesday said that the Bethlehem Steel Co. is not figuring in any manner with any steel company mergers, contrary to reports. He said that Pittsburgh and the United States are engulfed in a stream of prosperity and that already the United States is the dominant nation of the world, without waiting for the war to be over.

"What about the Bethlehem Steel Co. figuring in reports of steel company merger?" Mr. Schwab was asked.

"As far as I am concerned," was the answer, "no merger involving the Bethlehem Steel Co. is or has been in prospect. The company's organization is the same as it has been right along."

"What caused Bethlehem Steel stock to go to 600?"

"I do not know the cause. I have been neither a buyer nor a seller of Bethlehem Steel Co.'s stock. I am not interested in the price of the stock on the market. I have just the same amount of Bethlehem Steel Stock as I have had for some time."

"Do you think that Pittsburgh and the United States are due for unprecedented prosperity?"

"They are having that prosperity now."

"What relation have the war orders to continued prosperity?"

"The war orders do not cut as big a figure, from a tonnage standpoint, as the world attributes to them. As far as tonnage is concerned, our export business is not extraordinarily big."

"Henry Ford is quoted as saying that he is willing to give his entire fortune to bring about peace. What do you think about that?" was asked of the man who makes the big guns that the allies are using.

"That is very commendable in Mr. Ford," said Schwab, smiling.

**IRON AND STEEL.**

Iron Age says: Transactions in Lake Superior iron ore are on verge of closing which, it is believed, will establish a price of \$4.25 for Mesaba bessemer and \$3.55 for Mesaba non-bessemer ore, an advance of 80 cents for the former and 70 cents for the latter on prices of this year. Old-range ores, according to present indications, will sell at an advance of about 75 cents over 1915 schedule instead of \$1, as favored by some producers.

Difficulty of forcing pig iron production above the present rate appears in statistics for November. At 3,037,308 tons for last month, output was 101,244 tons a day, against 3,125,491 in October, or 100,822 tons a day. Steel company furnaces could not keep up the pace they made in the October strain for high records. Some may be expected to go out soon for relining, as the hard driving of many months is telling.

On December 1st the capacity of the 284 active blast furnaces was 103,033 tons a day, against 101,819 a day for 276 furnaces on November 1st, this last rate being based on the unusual outputs of October. Production is now at rate of 38,000,000 tons a year, allowing 400,000 tons for charcoal iron.

Iron markets in central West are showing little restraint in advances. At Chicago sales are numerous and readily closed at rising prices. In Ohio prices have gone up 50 cents to \$1 on no large buying, but on the great extent to which producers find capacity taken up for first half.

In steel-making iron advances are readily made, bessemer having sold at \$18.50 and \$19 at furnace, while

basic has brought as high as \$18. For example, been offered for bessemer.

**DEMAND FOR IRON ORE.**

Pittsburgh—Estimates continue to be made that to support comfortably present rate of pig iron production, fully 37,500,000 tons a year, there should be at least 60,000,000 tons of Lake Superior iron ore shipped next season. The maximum movement occurred in 1913, almost 50,000,000 tons. That proved to be too much, as pig iron production decreased, only 27,000,000 tons being made from July 1, 1913, to July 1, 1914. In 1914 shipments fell off almost one-third, but pig iron production decreased only one-seventh, and thus all or part of the surplus was absorbed. Production of pig iron up to the opening of navigation next year promises to be much in excess of the proportion that would be indicated by shipments in the season just closed, about 47,000,000 tons.

Doubts are expressed whether 60,000,000 tons of Lake Superior ore can be moved next season. Somewhat more than 50,000,000 tons of ore could have been moved in 1913, but the Lake fleet has since been reduced by smaller vessels going out for ocean trade, nearly all, indeed that were short enough to go through the locks of the Welland Canal, and by losses from storms, while very few new boats have been built, and only a half dozen or so are to be completed for next season's use. The United States Steel Corporation apparently expected a shortage, as recently it chartered boats for next season to the extent of nearly 10,000,000 tons, and owners of the remaining boats are now indisposed to accept charters, preferring apparently to hold their capacity for high "wild" rates as the season progresses. Some ore interests are reported as negotiating to buy boats since they cannot charter them.

In the history of the Lake Superior ore trade for the past fifteen years or more, a vessel scarcity has hardly ever been threatened, there being usually ample carrying capacity for the ore that could be mined.

**NOVA SCOTIA STEEL AND COAL CO.**

The Nova Scotia Steel and Coal Company is rushing forward the construction of the additional plant to take care of the new orders received and the work is being carried out night and day with a view of completing it in record time. At the same time as the plants are being erected arrangements have also been completed for delivery of the necessary machinery.

**SILVER PRICES.**

	New York.	London.
	cents.	pence.
November—		
25 .....	Holiday	26 1/4
26 .....	56	27
27 .....	56 3/8	27 1/4
29 .....	56 3/8	27 3/8
30 .....	56 3/8	27 3/8
December—		
1 .....	56 1/8	26 1/8
2 .....	55 3/4	..
3 .....	55	26 3/8
4 .....	55	26 3/8
6 .....	56 1/4	27 3/8
7 .....	56 1/8	26 1/8
8 .....	55 3/4	26 3/4



# MARKETS

## MARKETS.

Dec. 8, 1915—Connellsville coke (f.o.b. ovens)—  
 Furnace coke, prompt, \$2.15 to \$2.25 per ton.  
 Foundry coke, prompt, \$3.00 to \$3.25 per ton.  
 Straits Tin, 37.25 cents.  
 Copper—  
 Prime Lake, 19.37½ to 19.62½ cents.  
 Electrolytic, 19.25 to 19.50 cents.  
 Casting, 18.75 to 19.00 cents.  
 Lead, Trust price, 5.25 cents.  
 Lead, outside, 5.25 cents.  
 Spelter, prompt Western shipment, 14.92½ to 15.42½ cents.  
 Antimony—  
 English brands, nominal.  
 Chinese and Japanese, 39.00 to 39.50 cents.  
 American, 39.00 to 39.50 cents.  
 Aluminum—  
 Virgin, 99 per cent., 58.00 to 59.00 cents.  
 Pure, 98 to 99 per cent., 56.00 to 58.00 cents.  
 Remelted No. 12 alloy, 48.00 to 50.00 cents.  
 Nickel, 45.00 to 50.00 cents.  
 Cadmium, nominal, \$1.25 to \$1.50.  
 Quicksilver, \$125 to \$130.  
 Platinum, nominal, \$85.00 to \$100.00.  
 Cobalt (metallic), \$1.25.  
 Silver (official), 55¾ cents.

Metal Products.—Owing to the withdrawal of all price lists by the leading manufacturers of brass and copper products, quotations appearing below are based on the outside market and are likely to change at any moment. All prices are nominal as follows:

Sheet copper, base 25.00 cents.  
 Copper wire, base, 20.75 to 21.00 cents.  
 High sheet brass, base, 27.00 to 27.50 cents  
 Seamless brass tubing, 31.00 cents.  
 Brazed tubing, 31.50 cents.  
 Seamless copper tubing, 29.50 cents.  
 Brass wire, 27.00 to 27.50 cents.  
 Brass rods, 27.00 to 27.50 cents.  
 Sheet zinc, f.o.b. smelter, 22.00 cents.

### STOCK QUOTATIONS.

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

New York Curb.	Bid.	Asked.
Atlanta	23.00	25.00
Canada Copper	2.06¼	2.18¾
American Marconi	362.50	387.50
Canadian Marconi	100.00	200.00
Belmont	4.50	4.62½
Braden	15.87½	16.00
Goldfield Cons.	1.18¾	1.25
Jim Butler	1.06¼	1.12½
Jumbo Extension	1.18¾	1.25
Riker Hegeman	5.25	5.50
Standard Silver-Lead, B.C.	1.87½	2.00
Stewart Mining	.56⅞	.62½
Tonopah Extension	4.00	4.06¼
Tonopah Mining	6.87½	7.12½
United Profit Shar.	187.50	193.75
Victor Oil	3.00	3.25
West End. Cons.	.83	.85
Yukon Gold	2.75	3.00
Anglo Amn. Oil	18.00	18.50
Standard Motors	9.75	10.25
Submarine Corp.	46.50	46.75
Kennecott Copper	53.50	53.75
Maxim Munitions	13.62½	13.87½
Int. Marine	16.62½	16.87½
Do. pref.	64.25	64.50

Standard Oil of N. Y.	215.00	218.00
Standard Oil of N. J.	505.00	508.00
Standard Oil (old)	1625.00	....
Standard Oil (subs)	1120.50	....

Porcupine Stocks.	Bid.	Asked.
Apex	.05¾	.05⅞
Dome Extension	.33	.34½
Dome Lake	.23	.24
Dome Mines	28.50	29.00
Eldorado	.00¼	.00½
Foley O'Brien	....	.58
Hollinger	29.00	29.50
Jupiter	.19½	.20
McIntyre	1.01	1.02
Moneta	.09½	.09¾
Plenaurum	.78	.80
Porcupine Imperial	.05	.05¼
Porcupine Crown	.91	....
Preston East Dome	.06¾	.06⅞
Dome Consol	.20	.21
Gold Reef	....	.02
Homestake	.24	.30
McIntyre Ext.	.32½	.33
Porcupine Vipond	.78	.79
West Dome	.16¾	.17

Cobalt Stocks.	Bid.	Asked.
Bailey	.04⅞	.05
Beaver	.47½	.48
Buffalo	1.05	....
Chambers Ferland	.25¼	.25½
Coniagas	....	5.00
Crown Reserve	.63	.65
Foster	.07	.08½
Gifford	.04	.05
Gould	.00½	.00¾
Great Northern	.05	.05⅞
Hargraves	.02⅞	.03
Hudson Bay	23.00	....
Kerr Lake	4.50	5.00
La Rose	.69	.70
McKinley	.65	.70
Nipissing	7.50	7.75
Peterson Lake	.36	.36¼
Right of Way	.04	.05
Silver Leaf	.03	.03¼
Teck Hughes	.14	.15
Temiskamir	.67½	.68
Trethewey	.17	.18
Wetlaufer	.08½	.09
Seneca Superior	....	.75
York Ontario	.01	.01¼
Ophir	.10	.11
Shamrock Cons.	.19¾	.20
Adanac	.24	.25

### TORONTO MARKETS.

Dec. 13, 1915—(Quotations from Canada Metal Co., Toronto)  
 Spelter, 21 cents per lb.  
 Lead, 6¾ cents per lb.  
 Tin, 42 cents per lb.  
 Antimony, 48 cents per lb.  
 Copper casting, 20¾ cents per lb.  
 Electrolytic, 20¾ cents per lb.  
 Ingot brass, yellow, 13c.; red, 15 cents per lb.  
 Dec. 13, 1915—(Quotations from Elias Rogers Co., Toronto)  
 Coal, anthracite, \$7.75 per ton.  
 Coal, bituminous, \$5.25 per ton.