

CANADIAN **MINING JOURNAL**

VOL. XXXVII

TORONTO

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Recent Publications

The Nickel Industry: with special reference to the Sudbury region, Ont. Report on, by Professor A. P. Coleman, Ph.D.

The Copper Smelting Industry of Canada. Report on, by A. W. G. Wilson, Ph.D.

Building and Ornamental Stones of Canada (Quebec). Vol. III. Report on, by W. A. Parks, Ph.D.

The Bituminous Sands of Northern Alberta. Report on, by S. C. Ellis, M.E.

Peat, Lignite and Coal: their value as fuels for the production of gas and power in the by-product, recovery producer. Report on, by B. F. Haanel, B.Sc.

Annual Report of the Mineral Production of Canada During the Calendar Year 1913, by John McLeish, B.A.

The Petroleum and Natural Gas Resources of Canada: Vols. I. and II., by F. G. Clapp, M.A., and others.

The Salt Industry of Canada. Report on, by L. H. Cole, B.Sc.

Electro-plating with Cobalt. Report on, by H. T. Kalmus, Ph.D.

Electro-thermic Smelting of Iron Ores in Sweden. Report on, by A. Stansfield, D.Sc.

Non-metallic Minerals Used in Canadian Manufacturing Industries. Report on, by H. Frechette, M.Sc.

The Mines Branch maintains the following laboratories in which investigations are made with a view to assisting in the development of the general mining industries of Canada:—

Fuel Testing Laboratory.—Testing value of Canadian fuels for steam raising and production of power gas; analyses, and other chemical and physical examinations of solid, liquid and gaseous fuels are also made.

Ore-Dressing Laboratory.—Testing of Canadian ores and minerals, to ascertain most economical methods of treatment.

Chemical Laboratory.—Analysing and assaying of all mineral substances and their manufactured products. Copies of schedules of fees, which are slightly in excess of those charged by private practitioners, may be had on application.

Ceramic Laboratory.—Equipment is such that complete physical tests on clays and shale of the Dominion can be made, to determine their value from an economic standpoint.

Structural Materials Laboratory.—Experimental work on sands, cements and limes is also undertaken.

Applications for reports and particulars relative to having investigations made in the several laboratories should be addressed to **The Director, Mines Branch, Department of Mines, Ottawa.**

GEOLOGICAL SURVEY

Recent Publications

Memoir 34. The Devonian of Southwestern Ontario, by Clinton R. Stauffer.

Memoir 50. Upper White River District, Yukon, by D. D. Cairnes.

Memoir 56. Geology of Franklin Mining Camp, British Columbia, by C. W. Drysdale.

Memoir 57. Corundum, its Occurrence, Distribution, Exploitation and Uses, by A. E. Barlow.

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

Memoir 64. Preliminary Report on the Clay and Shale Deposits of the Province of Quebec, by J. Keele.

Memoir 65. Clay and Shale Deposits of the Western Provinces (Part 4), by H. Ries.

Memoir 66. Clay and Shale Deposits of the Western Provinces (Part 5), by J. Keele.

Memoir 68. A Geological Reconnaissance Between Golden and Kamloops, B.C., along the Canadian Pacific Railway, by R. A. Daly.

Memoir 69. Coal Fields of British Columbia, by D. B. Dowling.

Memoir 73. The Pleistocene and Recent Deposits of the Island of Montreal, by J. Stansfield.

Memoir 74. A List of Canadian Mineral Occurrences, by Robert A. A. Johnston.

Memoir 76. Geology of the Cranbrook Map-area, British Columbia, by S. J. Schofield.

Memoir 77. Geology and Ore Deposits of Rossland, British Columbia, by C. W. Drysdale.

Memoir 78. Wabana Iron Ore of Newfoundland, by A. O. Hayes.

Memoir 79. Ore Deposits of the Beaverdell Map-area, by L. Reinecke.

Memoir 81. The Oil and Gas Fields of Ontario and Quebec, by W. Malcolm.

Memoir 82. Rainy River District of Ontario. Surficial Geology and Soils, by W. A. Johnston.

Applicants for publications not listed above should mention the precise area concerning which information is desired.

Maps published within recent years may be had, printed on linen, at the nominal cost of ten cents each.

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

Communications should be addressed to **The Director, Geological Survey, Ottawa.**

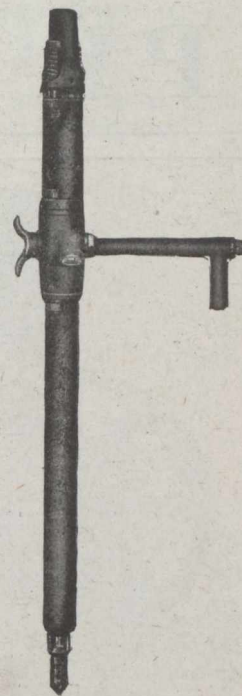
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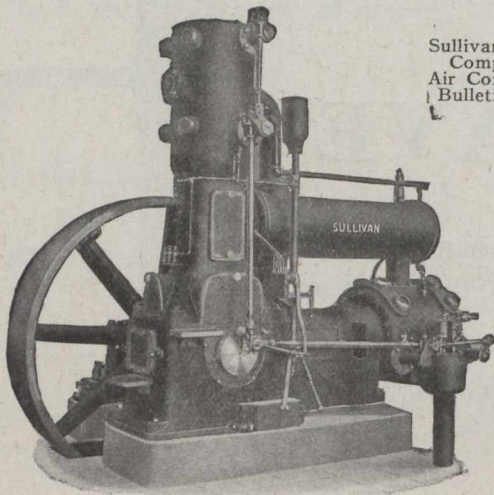
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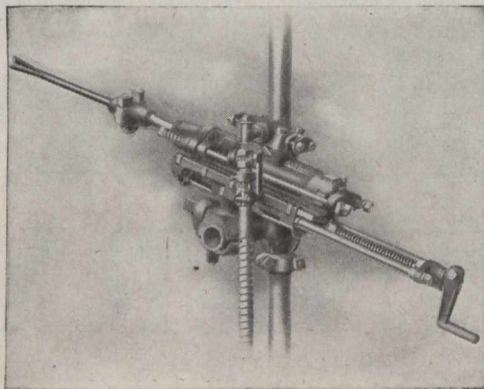


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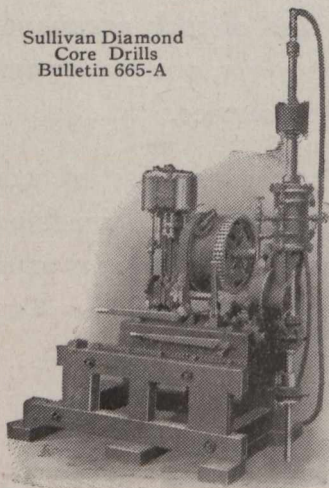


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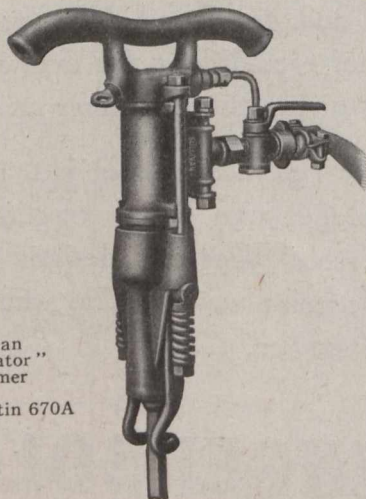
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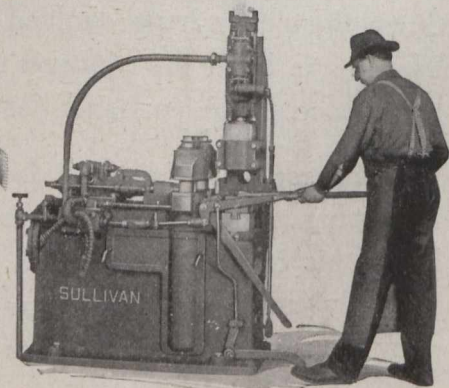
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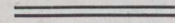
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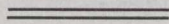
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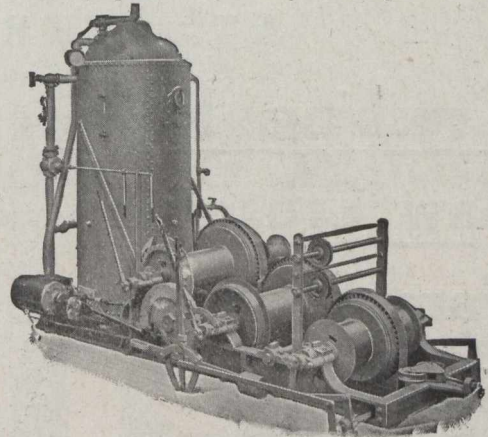
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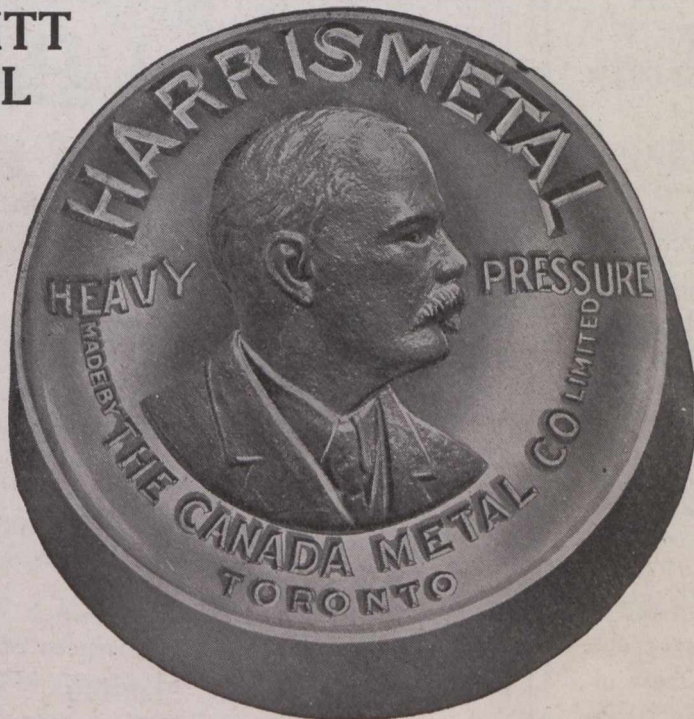
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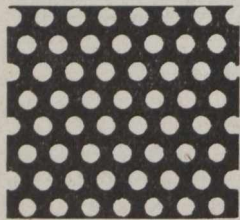
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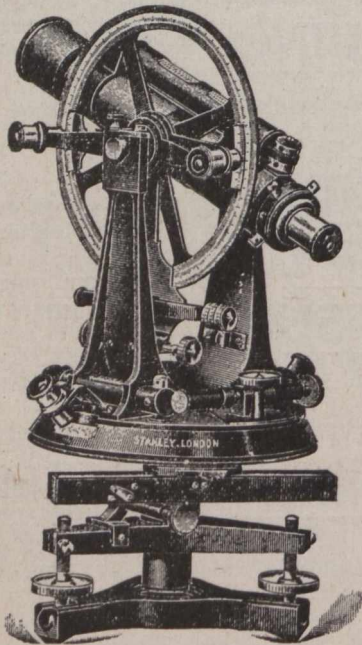
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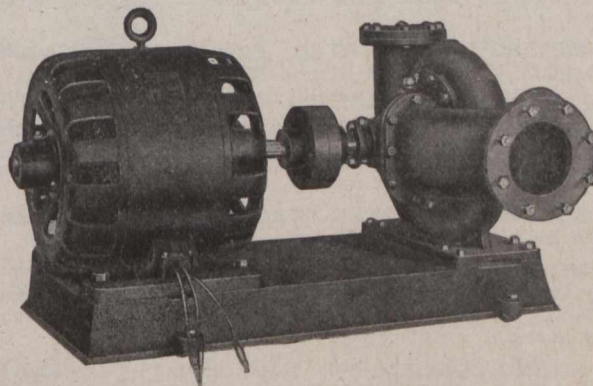
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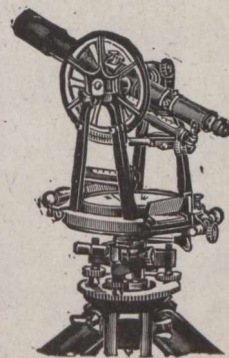
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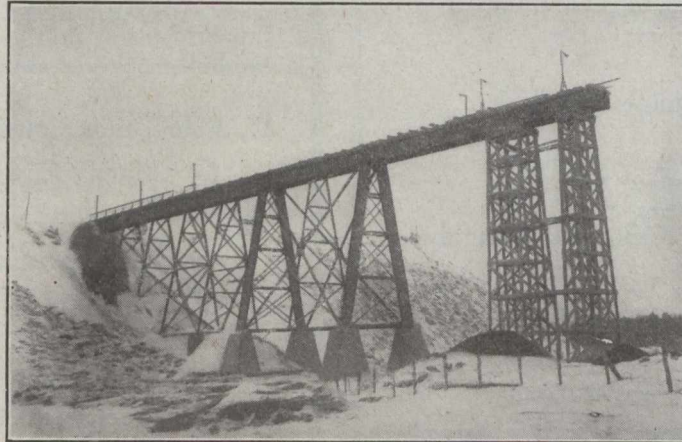
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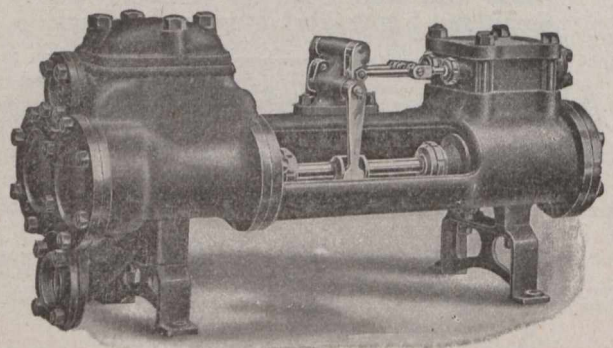
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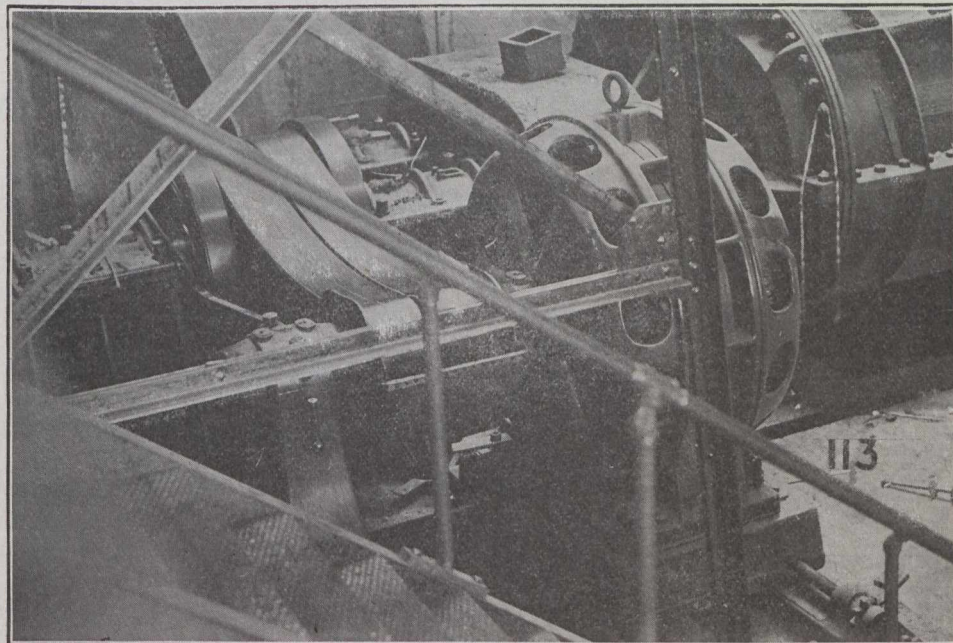
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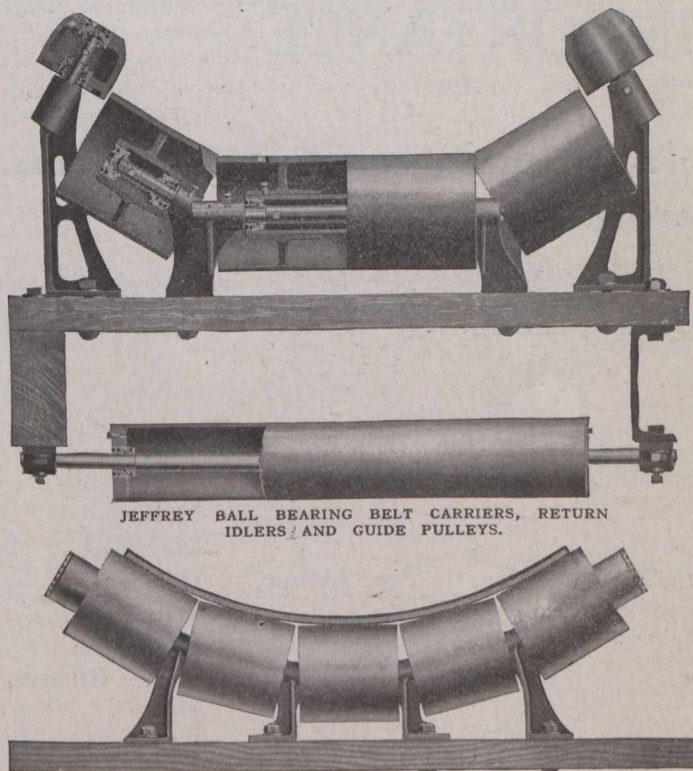
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THE CANADIAN MINING JOURNAL

VOL. XXXVII.

TORONTO, May 1, 1916.

No. 9

The Canadian Mining Journal

With which is incorporated the

"CANADIAN MINING REVIEW"

Devoted to Mining, Metallurgy and Allied Industries in Canada.

Published fortnightly by the

MINES PUBLISHING CO., LIMITED

Head Office 263-5 Adelaide Street, West, Toronto

Branch Office 600 Read Bldg., Montreal

Editor

REGINALD E. HORE

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

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

CIRCULATION

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

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PORCUPINE

As a producer of gold, Ontario has made very rapid strides during the past five years. Porcupine, in 1909 a thickly forest-covered area with no industries and scarcely any inhabitants, is now one of the busiest centres in the Province. It is now producing gold in such quantity and has such great promise for the future that there is good reason to believe that gold mining in Ontario is destined to become a much greater industry than silver mining at Cobalt ever was. Cobalt has an excellent record and has placed Ontario high in the list of producers of silver. Cobalt has made itself felt in countless ways in the older parts of Ontario. Cobalt has produced at low cost silver worth many millions, has given profitable employment to several thousand men, and has made a market for supplies of all kinds, a market that the manufacturer and merchant have learned to appreciate. We contrast Porcupine with Cobalt, therefore, without disparaging the latter, but in order to emphasize what we believe to be the importance to Ontario of the gold mining industry which has so recently been established in the province.

SILVER

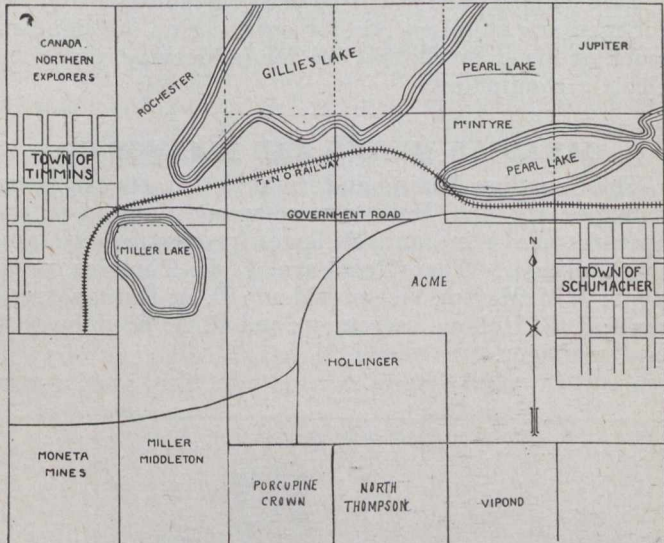
The price of silver has risen so rapidly during the past few months that it is difficult to keep track of the actual increase in the value of silver mines which the increased selling price has made. In 1915 Ontario's silver output was 23,730,839 ounces. The average selling price was 49.69 cents. Silver is now selling at about 18 cents higher than the average for 1915. The increased profit if the 1915 output had been sold at this price would be over \$4,000,000. What the production will be in 1916 is difficult to estimate. It will probably be considerably lower than that of 1915 unless special endeavor is made to take advantage of the high price available. As it is generally believed that the price is more likely to rise than to fall, no special effort to market ore may be made. There can be no doubt, however, that more development work will be done at Cobalt this year than for some time past, both at producing mines and on prospects. Claims now idle will receive attention. The increased price of silver is of great importance not only to the silver mining companies but to Ontario as a whole.

Ontario's mineral production in 1915 had a value of \$57,532,844. The value of the metallic products was \$47,721,180. It will not be surprising if the value of metallic products in 1916 exceeds last year's total for metallic and non-metallic combined.

HOLLINGER

The Hollinger is Canada's leading gold mine. It produced in 1915 334,750 tons of ore which yielded \$9.67 per ton. The reserves are very large and a long and profitable life is assured. The property was dis-

mine warrants further large additions being made to plant and provision had been made for such expenditures before the war tax on profits was announced. The war tax as originally announced would have taken a very large share of the Hollinger profits and would



Hollinger and neighboring properties

covered in 1909 by Ben Hollinger and taken over in the same year by a syndicate composed of N. A. Timmins, L. H. Timmins, John McMartin, Duncan McMartin and D. A. Dunlap. A small production was made in testing the ore. A 30-stamp mill built in 1911 was destroyed by fire. Another was built in the following year and production on a large scale was first made in 1912 and in November, 1912 distribution of dividends began. During 1913 and 1914 dividends totalling \$1,170,000 per year were paid. In 1915 dividends totalled \$1,560,000. The milling capacity has been increased from time to time. During the four weeks ending March 24, 1916 there was treated 28,712 tons of ore averaging \$9.04 per ton.

For some reason, probably because of uncertainty as to the amount to be collected by the Government in taxes, the Hollinger report for 1915 has not yet been



Gold Ore, Hollinger mine

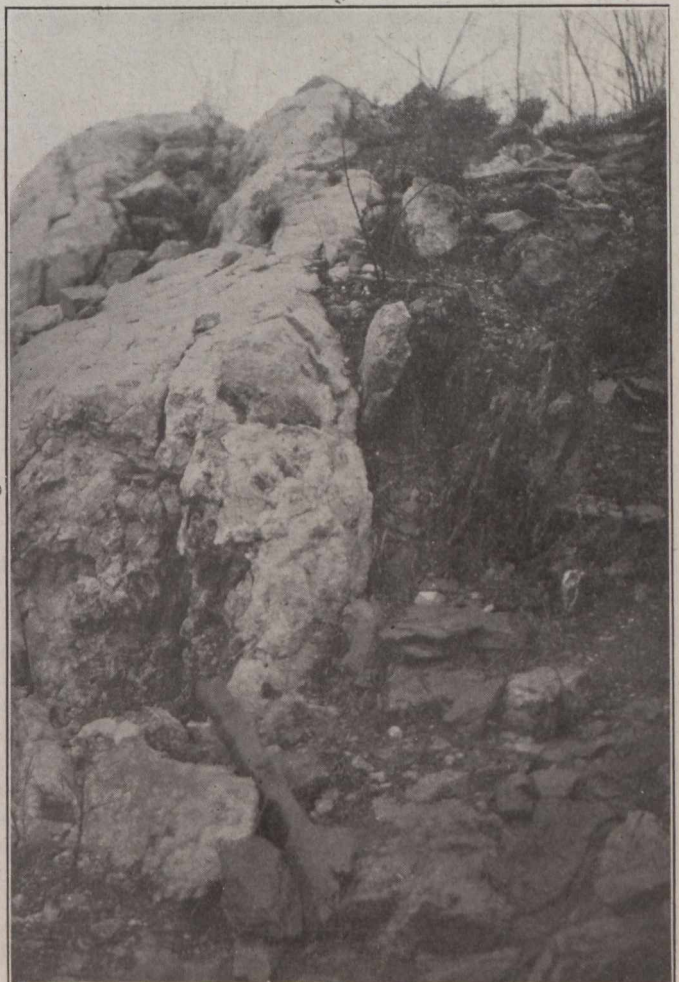
have prevented necessary expenditures for enlarging the plant. It is expected, however, in view of Sir Thomas White's explanations, that while the Hollinger will have to contribute a considerable amount on account of the tax it will be a much smaller amount than the budget speech indicated, and should not seriously interfere with plans for increasing production.



Gold Ore, Hollinger mine

issued. It will doubtless show a substantial increase in ore reserves and prove that the property is a very valuable one.

During the past few years the Hollinger has necessarily made large expenditures for plant, but has been able to pay large dividends at the same time. The



Gold Quartz, Millerton mine

The Hollinger mine is operated by the Canadian Mining and Finance Co. and the plans for extension of operations include provision for operating the Acme and Millerton.

It is generally believed that some plan for consolidation of the three properties has been worked out and will soon be announced. Nothing authoritative concerning such a merger is, however, yet obtainable. These three properties if operated as one would make one of the greatest mines in the world.

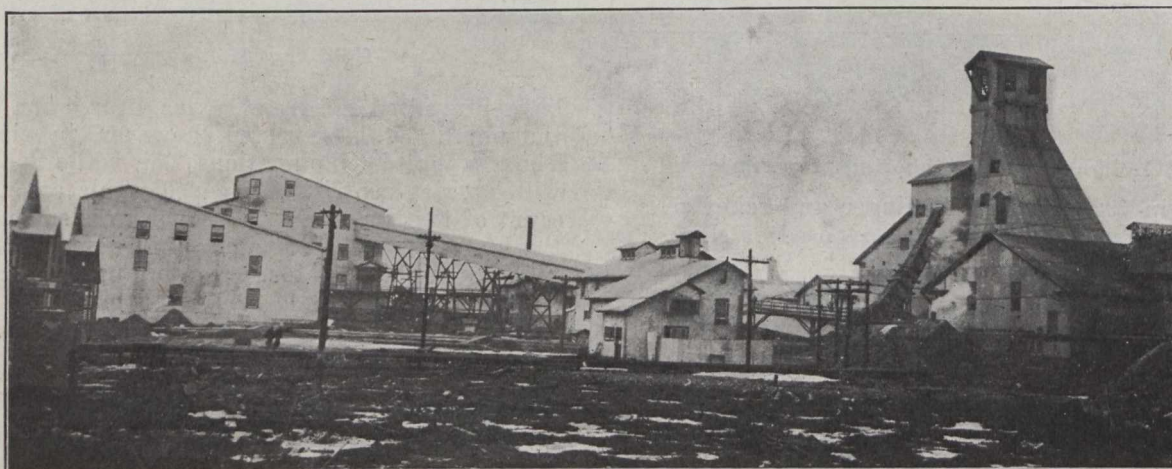
General Manager P. A. Robbins, in his report for four weeks ending March 24th, 1916, states that gross profits for the period amounted to \$151,302.63. Expenditures for plant during the four weeks amounted to \$19,598.10. Total working costs were \$101,287.31, an average of \$3.527 per ton of ore milled. There was hoisted from stopes 25,887 tons ore, and from development work 2,880 tons ore. Waste rock from development amounting to 1,950 tons was hoisted, bringing the

ton properties. This shaft has six compartments. Cross-cuts to tap the various orebodies will be driven at the 425, 800 and 1,250-ft. levels and electric locomotives will be used to haul the ore to the shaft. The ore will be crushed underground and then hoisted. At the surface it will be delivered to secondary crushers.

Two compartments will be used for hoisting ore, two for men and supplies, one for carrying on development work at lower levels and ore for ladderway, pipes and electric conductors.

CANADIAN MINING AND FINANCE CO.

The Canadian Mining and Finance Co. acts as general manager for the Hollinger company and owns and operates the Acme and Millerton properties adjoining the Hollinger. The officers are: L. H. Timmins, president; J. McMartin, vice-president; D. A. Dunlap, treasurer; J. B. Holden, secretary; and P. A. Robbins, general manager.



HOLLINGER MINE, TIMMINS, ONT.

ore and waste up to 30,717 tons. The mining cost was \$55,629.29, an average of \$1.93 per ton of ore milled.

The mill ran 92.3 per cent. of the possible running time, treating 41,493 tons, of which 28,712 was Hollinger ore and 12,781 tons was treated for Acme Gold Mines, Ltd. The average value of Hollinger ore treated was \$9.04. Milling costs on 28,712 tons were \$0.92 per ton.

ACME

The property of Acme Gold Mines, Ltd., adjoins the Hollinger. It is operated by the Canadian Mining and Finance Co., Ltd. The development work has proven the Acme to be one of the best properties at Porcupine. Large bodies of ore of good grade have been blocked out and it is evident that the Acme will make big profits. The estimated value of the ore reserves has not yet been made public, but it is expected that an announcement will soon be made.

It is understood that the Acme has ore reserves which warrant the construction of a much larger mill and cyanide plant. During 1915 106,486 tons ore, yielding \$9.67 per ton, was milled.

THE HOLLINGER-ACME SHAFT.

The Canadian Mining and Finance Co. is sinking a central shaft to serve the Hollinger, Acme and Miller-

ONTARIO'S MINES.

"The materials mined in Ontario are silver, gold, copper, nickel, iron, graphite, pyrites, talc, mica, feldspar, gypsum and corundum. The gold, silver, nickel, copper and iron are produced principally in the northern part of the province and the graphite, talc, mica, feldspar and corundum in the southeastern sections. As regards the importance of these deposits, it is claimed that Ontario has the largest body of high-grade talc on the continent in the Cross and Wellington talc mine at Madoc; the largest body of high-grade feldspar on the continent in the Richardson mine near Verona; the greatest mica mine on the continent at Sydenham; the greatest graphite mine at Calabogie; the greatest nickel deposits in the world at Sudbury; the richest silver camp in the world at Cobalt, and the most promising of the younger gold camps on the continent at Porcupine."—T. F. Sutherland, in E. & M. J.

KRIST.

Arrangements have been made for development of the Krist property which adjoins the North Thompson at Porcupine. Work will soon be begun on the property.

The Hollinger report for 1915 has not yet been issued. In view of the rumored merger of Hollinger and adjoining properties it will be of special interest.

DOMES

The Dome mine is being operated with excellent results. The orebodies are very large and the cost of mining lower than at other Porcupine mines. During 1915 a large body of ore of higher grade was opened up at the sixth level and when this is being more largely drawn on the profit per ton will be considerably higher.

The 80-stamp mill now in operation has proven to be too small for the mine. A large tonnage is being handled and additions have been made wherever possible to increase the capacity. During 1915 there was milled 317,740 tons ore which yielded an average of \$4.79 per ton. A larger tonnage and higher grade ore will be milled this year. If future development in the mine is as successful in opening new orebodies as previous work has been, the construction of a new mill cannot be avoided.

The Dome orebodies are of such a size that methods of mining quite different from other Ontario gold mines have been adopted. A large portion of the pres-

way. The results obtained will doubtless greatly influence the design of the new mill.

Recently the Dome have secured an option on the adjoining property of the Dome Extension. Prospecting of the ground between the Dome shaft and Dome Extension and of the latter property will be conducted from a crosscut to be driven from the new shaft. This ground is as yet unexplored. That it may prove valuable is indicated by the result of other underground work at the Dome, good ore having been found in driving the crosscut to connect with the new shaft at the seventh level.

DOMES EXTENSION.

The Dome Extension Mines Co., Ltd., owns five claims adjoining the Dome mine. Development work was recently resumed by the company and additional work will be done from the Dome mine by Dome Mines, Ltd., the latter having recently secured an option on Dome Extension.



GOLD QUARTZ AT DOME MINE

ent production is made from open pits. The underground openings are very large and the method of mining will be similar to that at the Creighton nickel-copper mine.

At the Dome a central shaft, five compartments, is being sunk. Good progress has been made. Preparations for erection of the head frame are now under way. There will be two hoists, one being used only for raising and lowering men.

Some time ago it was decided to install an enormous crusher underground. This crusher is not yet in operation, but work on the crusher station has been resumed. In the stopes the ore breaks very large and much has to be broken up by block-holing. The underground crusher will be for preliminary reduction only. At surface another crusher will be installed.

In the mill a Hardinge ball mill is now in operation and a second will soon be erected. A large tonnage is being handled by the ball mill and considerable importance is attached to the competitive test now under

WEST DOME.

Cobalt, April 22.—On the West Dome Consolidated a diamond drill is now running. It is being put down at an angle for a distance of about 800 feet, so that it will give indications what may be found below the present shaft at 600 to 700 feet. After a good deal of trouble—for the plant was left in very bad repair—it has been possible to resume operations in the old incline shaft put down on a quartz vein at an incline of 65 degrees. The shaft follows one vein down and there is another vein in the north drift and another in the south. Very little information was available as to results obtained from these veins, but they will now be carefully sampled. There were no less than seven shafts sunk on the property but for the present underground operations will be confined to the one. The incline shaft will be sunk to the 300-foot level when it is probable a new plant will have to be installed, if it is decided to explore from this shaft.—Northern Miner.

HYDRO-ELECTRIC POWER AT PORCUPINE

Water power is an important factor in all the important mining districts in Ontario. A brief report by Mr. W. R. Rogers of the Ontario Bureau of Mines, on the water powers of Porcupine district was recently published. Mr. Rogers says in part:

"All the hydro-electric power furnished the Porcupine camp comes from two plants situated on the Mattagami river, a tributary of the Moose flowing into James Bay. The location of the power plants with respect to the mining area is indicated on the accompanying sketch map. Both of these were formerly



Sketch map showing location of water powers at Porcupine

independent plants, but now are controlled and operated by the Northern Canada Power Company, Limited. The two plants are provided with inter-switching facilities, so that they work continually in parallel. The new company has expended a great deal of money in new construction replacements, and betterments, so as to guarantee to power users continuous and satisfactory service.

Storage of water is perhaps the most vital point in connection with any hydro-electric development. It is absolutely essential that the water supply be continuous. High-water periods in Northern Ontario are at the time of the spring breakup, and to a much less extent during the late autumn, when rains are usually fairly abundant. February and March have been the months when water becomes scanty, particularly in those winters when the usual thaws did not occur. How to provide for low-water periods without reliance upon auxiliary steam plants is a problem that can be solved only when abundant storage is possible. The experience of the power plants on the Mattagami river has very definitely established this fact.

Pondage may be considered as the close-at-hand storage of water immediately available for use in the turbines. It is a necessary precaution in Ontario water powers in order to provide against ice troubles as well

as to meet local fluctuations in power needs during the day. Three distinct types of ice are met with: surface or sheet, anchor, and frazil. The first, in addition to restricting the area of the channels, is liable to cause jams in the spring, cutting off the water supply or raising the tail water with a consequent loss of head. Anchor ice frequently rises in large masses, often carrying boulders and soil which are liable to damage the ice racks. Frazil ice, in the shape of needles, forms in rapids when the temperature is slightly below the freezing point. These needles or crystals gather in lumps and adhere readily to any surface with which they come in contact. Trouble from these latter sources is avoided when a long stretch of still water exists above the power house, while surface ice trouble is largely overcome by proper dam construction.

Prior to the erection of the large plant of the Abitibi Power and Paper Company at Iroquois Falls, on the Abitibi river, where an installation of 19,500 horse-power was first operated in August, 1914, the two power plants on the Mattagami river were the only ones in Ontario on the James Bay slope. Consequently their experience is of value to other power developers and users. The James Bay drainage basin is very conservatively estimated as capable of developing 1,500,000 horse power, or 30 per cent. of the total potential water power of the Province of Ontario.

TOUGH-OAKES DECISION.

Toronto, April 25.—Judgments were given at Osgoode Hall of Mr. Justice Kelly in the twin actions concerning the control of the Tough-Oakes Mining Co. He continues to trial the injunction asked by C. A. Foster, restraining Myrtice Oakes and Winifred Robins from disposing of two blocks of stock aggregating 40,000 shares of \$5 each, which, he alleges, he bought from them. The interim injunction had been granted by Mr. Justice Latchford.

Mr. Justice Kelly dismisses the application of Harry Oakes, W. H. Wright, J. W. Morrison, R. J. Robins, J. B. Holden, Albert Burt, and James Y. Murdoch, for an injunction restraining C. A. Foster, J. H. Tough, T. B. Tough, George Tough, E. W. Kearney and W. H. M. Jones, acting as directors of the Tough-Oakes Mining Co.

The company was incorporated in 1913, with a capital stock of \$3,000,000, of which 531,500 shares have been issued.

The controversy over the control of Tough-Oakes was brought to a head at the annual meeting of the company last January, in Haileybury, when C. A. Foster, the president, claimed that there was not sufficient stock represented to make a quorum and dismissed the meeting. Harry Oakes and his associates differed with the president and went ahead and elected a new board of directors. The ruling of Mr. Justice Kelly leaves the old directorate with Mr. Foster, as president, in control, as before.

In the meantime, while the legal entanglements were being cleared up, production at the mine went on as usual.—Toronto World.

LAKE SHORE MINE.

Kirkland Lake, April 22.—Probably the most important discovery at the Lake Shore mine to date has just been made on the 300-foot level. The new vein is about seven feet wide and for a width of seven inches averages \$400 a ton. It was cut in a crosscut north from the main drift, about 300 feet west of the shaft.

MCINTYRE PORCUPINE MINES

In a letter to shareholders, dated April 14th, 1916, President A. M. Hays says:

The following is a summary of production and development operations for the quarter ended 31st March, 1916: Tons milled, 27,248; value per ton, \$7.74; gross value, \$210,840; recovery, \$201,110—95.4 per cent.; operating cost, \$104,982—\$3.85 per ton; operating profit, \$97,128.

Owing to vexatious delays in obtaining delivery of necessary parts of the plant, the mill addition was not ready for operation until towards the end of March, so that the tonnage treated during the period is only slightly in excess of the tonnage treated for the quarter ending 31st December last. The value of ore treated, however, was 35 cents per ton higher, while the operating costs were 31 cents per ton lower, giving an increased operating profit of \$21,643 for the quarter. The mill is now operating satisfactorily and should be running to its full capacity of 450 tons per day before the end of the present month.



Gold Ore in McIntyre Mine

Developments underground have continued to be satisfactory. At No. 5 shaft on the 700-foot level a crosscut to the north intersected a large orebody which had been previously cut by diamond drilling. The width of the vein at the point of intersection was 17 feet of high grade milling ore. In continuing this crosscut to the north, a parallel vein was intersected at a distance of 12 feet beyond the orebody just referred to, showing high grade milling ore $4\frac{1}{2}$ feet in width. There have been no recent developments of any importance at No. 4 shaft, which is now being operated to the 600-foot level. Sinking operations to greater depths will shortly be commenced.

McIntyre Extension.

The main working shaft on the McIntyre Extension property was completed during last month to a depth of 1,000 feet, where a working station has been cut out. The shaft was continued to a depth of 1,083 feet in order to make provision for ore and waste pockets below the level, with a suitable sump. These have now been completed and a crosscut has been started towards McIntyre No. 5 shaft in order to intersect at this depth the orebodies already proved by diamond drilling to exist to the depth of 750 feet, and as the crosscut is now being driven at the rate of over ten feet per day, the distance should be covered early in June, when a raise will be started to connect with No. 5 shaft at the 700 foot level.

McIntyre-Jupiter.

Work on the new power plant, as well as on the new shaft house (in which are being placed the crushing and sampling plant) has been seriously delayed by tardy delivery of material and machinery necessary for their completion. The final shipments, however, have now been made. A surface tramway is being constructed to No. 5 shaft on the McIntyre, a distance of about half a mile over an easy grade, from which point Jupiter ore will be transported by the existing aerial tramway to the McIntyre mill. The Jupiter shaft is now in operation to the 300-foot level, and a considerable amount of underground work has been accomplished. Unless something unforeseen happens the mining and milling of Jupiter ores should be commenced within the next week or ten days.

McCREA-KILROY.

South Porcupine, April 22.—The claims in Deloro next to the Pike Lake properties known as the Mc-Crea Kilroy Gold Mining Company are the scene of active development this week. The management will strip a wide dyke, which runs from 40 to 60 feet wide, and select a good place for sinking. During the winter considerable surface work was done and two test pits sunk.

Quite a number of old-timers have gravitated back to the Porcupine gold camp after an absence of several years. Optimism seems to be in the air, and a general activity in mining claims, especially in Deloro, is vouched for.—Porcupine Herald.

CROESUS GOLD.

At the Croesus gold mine in Munro township the incline shaft is being sunk from the 300 to the 400-foot level. A quantity of ore from the Croesus was milled in the Gold Pyramid mill, but the plant was so sadly out of date that only a very poor recovery was made. The building of a new mill is being considered now by the Croesus company.—Cobalt Nugget.

CONIAGAS IN DELORO.

During the winter Coniagas Mines, Ltd., through Mr. Clifford Smith, of Toronto, secured an option on claims in Deloro township. Supplies were taken in during the winter and development work will be carried on this summer. Mr. Smith is in charge of operations.

CROWN RESERVE AT BOSTON CREEK.

The Crown Reserve Mining Co., Ltd., is developing under option claims in the Boston Creek district. Mr. H. J. Stewart, assistant manager of the Crown Reserve, is in charge.

PORCUPINE CROWN MINES, LTD.

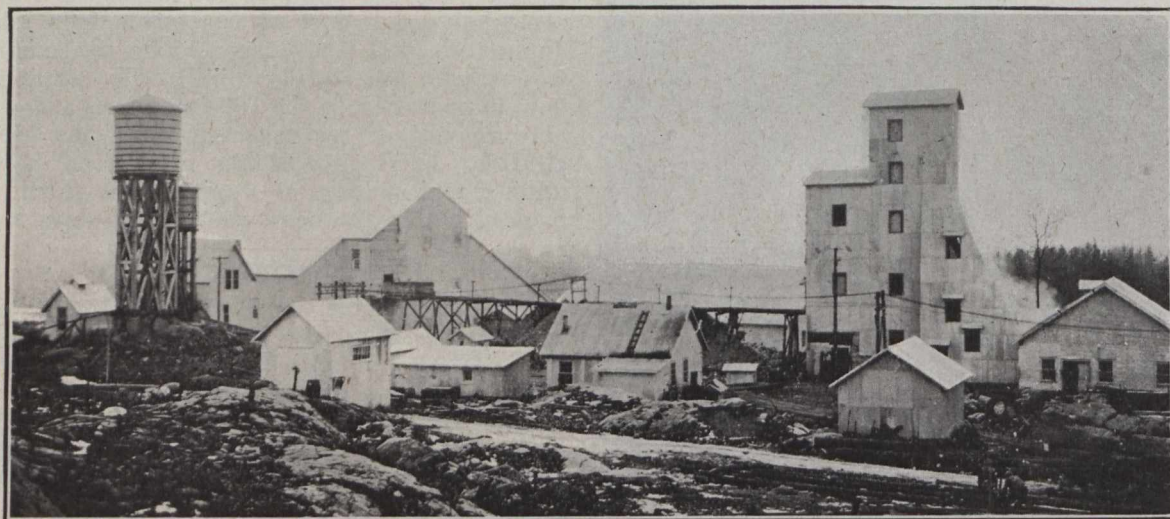
In a report of the operations of Porcupine-Crown Mines, Ltd., for the year 1915, Mr. S. W. Cohen, general manager, says:

The net value of the production of the property for the past year, after deducting mint charges, was \$613,565.43; 46,419 tons was milled, of which 41,326 tons came from the mine, and 5,093 tons from the tailings of the first amalgamation mill; 23,964 tons of broken ore is on the timbers in the mine; 4,569 feet of development and prospecting was driven, and 2,616 feet of diamond drilling was done.

The orebody which was encountered on the 200-foot level during the last month of 1914, was developed for a length of 150 feet. The ore is of different character from the original quartz vein, being mineralized schist with small quartz stringers, and averages 15 feet in width with a value of \$5.45 per ton. South of this point, another displacement of the vein shows a throw of about 100 feet. Beyond this, the vein was followed for about 140 feet showing \$5.00 ore for a width of 5 feet.

was at this level, as, previous to that period, there was very little satisfactory development accomplished. During the year, the ore was followed south of the No. 2 winze, and for 90 feet the vein showed \$13.00 ore for a width of 4½ feet. Beyond that point, the vein went into the wall, and where it opened up again, shows vein matter 4 feet in width, but of a value of less than \$5.00. Just above the No. 2 winze, the vein takes a roll, and for a height of 20 feet and a length of 25 feet, there is mineralized schist averaging \$9.00 in value for a width of 57 feet. This is in addition to the regular high grade vein of about 4 feet in width which exists at that point.

600-foot Level—On this level, 205 feet of drifting has been done and 69 feet of crosscutting. There is a vein of quartz for the whole length of the drift about 4½ feet wide. For 20 feet in length, this averages \$17.40. The rest of the drifting shows ore too low grade to mine. Work was temporarily discontinued to allow the winze to be sunk to the 700-foot level, but there is no reason to expect that further values will not be encountered at this level. The winze from this level to the 700 was sunk on the vein and showed values at



PORCUPINE CROWN MINE AND MILL

300-foot Level.—10,296 tons of ore was broken at this level, and 210 feet of drifting, and 363 feet of crosscutting was done.

The fault was also encountered on this level at the south end of the ore shoot discovered last year, and considerable crosscutting was necessary before the extension, which was thrown about 100 feet in the horizontal plane to the left, was discovered. It was this discovery that supplied the data that made it possible to locate the vein on the other levels. The extension of the orebody opened up this year is 180 feet in length, and 5 feet in width, of \$10.00 ore.

400-foot Level—12,184 tons of ore was broken, 376 feet of drifting, 494 feet of crosscutting, and 99 feet of raising was done on this level. The extension of the vein south of the second fault was opened up for 135 feet, showing a width of over 4 feet of \$23.00 ore. The second extension was also picked up at this level, but the grade of the ore is low.

500-foot Level—8,088 tons of ore was broken at this level, and 530 feet of drifting, 600 feet of crosscutting, 111 feet of raising, 96 feet of sinking, and 93 feet of shaft raising was done. The most interesting and important development in the mine during the past year

different points. Drifting has been started at the 700 and shows a quartz vein 3½ feet wide with values running from \$2.00 to \$7.00. The main shaft was put down to the 500-foot level, and a larger hoist is being installed.

Diamond Drilling.—Two thousand six hundred and sixteen feet of diamond drilling was done, all in flat holes. This work proved very effective in locating the extension of the vein at different points where faulting had caused a movement of the ore, and this method will be continued as a cheap and effective one to locate the orebodies.

The results of our mill operations have continued to be most satisfactory. The extraction on the regular mine ore was increased to 97.7 per cent., and this on a lower grade of ore than the average of last year. The old amalgamation tails were successfully treated at a very low cost and gave an extraction of 85.77 per cent. This, together with the extraction made in the original amalgamation mill, shows a total recovery of 97.87 per cent. on the ore mined before the installation of the cyanide mill. The cost of milling for the year was still further reduced to \$1.09 per ton.

Cost of Operation.

The operating costs were again materially reduced for the year.

	Per ton
The total cost of the ore treated, exclusive of the amalgamation tailings.....	\$6.72
The amalgamation tails were handled and treated at a cost of.....	0.97
The total average cost of treatment including everything.	6.09

Distribution of Costs.

	Cost per ton milled.
Mining, development, exploration and underground	\$121,242.54 \$2.93
Hoisting and trammng.....	13,482.50 .32½
Mill operations	45,036.48 1.09
Power, heat and maintenance...	50,935.07 1.23
Mine, general expense.....	21,394.81 .52
Administration, depreciation, insurance and taxes.....	25,870.88 .62½
Total.	\$277,962.28 \$6.72
Tailings, handling and treatment.	4,954.60 .97
	\$282,916.88
Total average cost per ton milled.....	\$6.09½
Gross value, production	\$615,537.60
Mint charges	1,972.17
	\$613,565.43
Mine operation costs.....	282,916.88
Mine operation, net profit.....	\$330,648.55

Ore Reserves.

During the current year, almost all of our ore was developed south of our main fault at the 200, 300, 400 and 500-foot levels. Ore was found on each of these levels, and developed up to the second fault which cut the vein, but was again picked up beyond the fault and developed into the quartz-porphry. The furthest point reached to the south was at the 200-foot level and is now within 150 feet of our south boundary. The general indications are that this formation, viz.: the quartz-porphry, limits our orebody in this direction, although this territory will be further proved to finally determine this fact. The character of the new ore developed is different from the original portion of the vein, as it consists of mineralized schist with quartz stringers instead of a solid quartz vein as existed originally.

Fifty thousand tons of ore, of a value of \$400,000.00 was blocked out during the past year. The present total ore reserves are equivalent to 150,000 tons of an approximate value of \$1,250,000. The estimate of this value is of course based on mine sampling, but as a result of the mill checks on the mine samples we may assume this estimate to be correct within 10 per cent.

Summary of Results in 1915.

The development of the property during the past year has been satisfactory. We have opened up an extension of the orebody to the south and at the lower

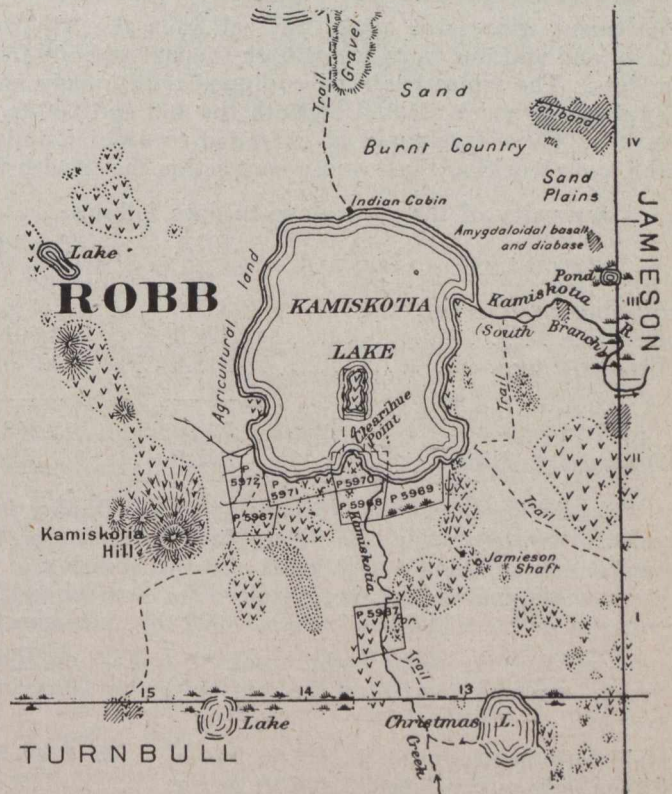
levels, have demonstrated the fact that although the ore is of lower grade where it does exist, it is of a value that will show a profit on operations. While the change in the character of the orebody reduces the grade per ton, the increase of tonnage gives us practically the same gold contents in the vein. Operating costs were appreciably reduced. Extraction in the mill was increased.

The company earned a profit of \$297,873.14 after wiping off all costs of broken ore left in the stopes, new development, depreciation, etc. Two hundred and forty thousand dollars was paid in dividends by the company, and \$57,873.14 was added to the surplus, making a net surplus of \$269,977.10.

KAMISKOTIA.

According to a report from Timmins the nine claims in the Kamiskotia district worked by the Porcupine Independence Mines, Limited, have been sold. This property is located in Jamieson township, at the junction of the north and south branches of the Kamiskotia river.

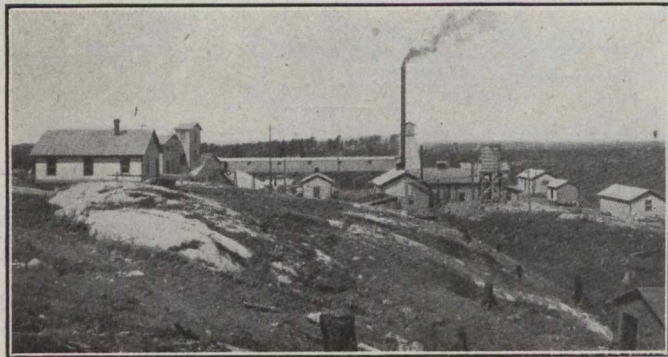
These properties were secured in the early days of the camp and the Porcupine Independence Mining Co.



PORCUPINE VIPOND MINES, LTD.

In his report to the president and directors of the Porcupine Vipond Mines, Ltd., on the operations of the company during the year 1915, Manager C. H. Poirier says:

During the year the drifts on the 200-foot level were extended to the west limits of the North Vipond lot and the continuation of the ore-bearing zone proven to the boundary of the property. A vertical, two com-



PORCUPINE VIPOND MINE

partment winze was sunk 220 feet from the 300-foot level and stations were cut at both the 400 and 500-foot points. The winze has been equipped with a cage and exploration work started on both the 400 and 500-foot levels. These levels will be extended to a point under the main working shaft and a connection made with it.

A summary of the work done to date follows:

	1915.	Total to date-ft.
Sinking and raising.....	381.5	1,176.5
Drifting.....	1,198.9	4,101.3
Crosscutting.....	218.6	1,975.6
	1,799.0	7,253.4
Diamond drilling.....	524.0	524.0

The mill has been in continuous operation during the year. The installation of a 6-foot Hardinge ball mill, to replace one of the 4½-foot units and the building of a storage bin for the crusher resulted in increasing the capacity of the mill from 3,000 to 4,000 tons per month.

Thirty-five thousand eight hundred and ninety-nine tons of ore was treated in the mill, with the following results:

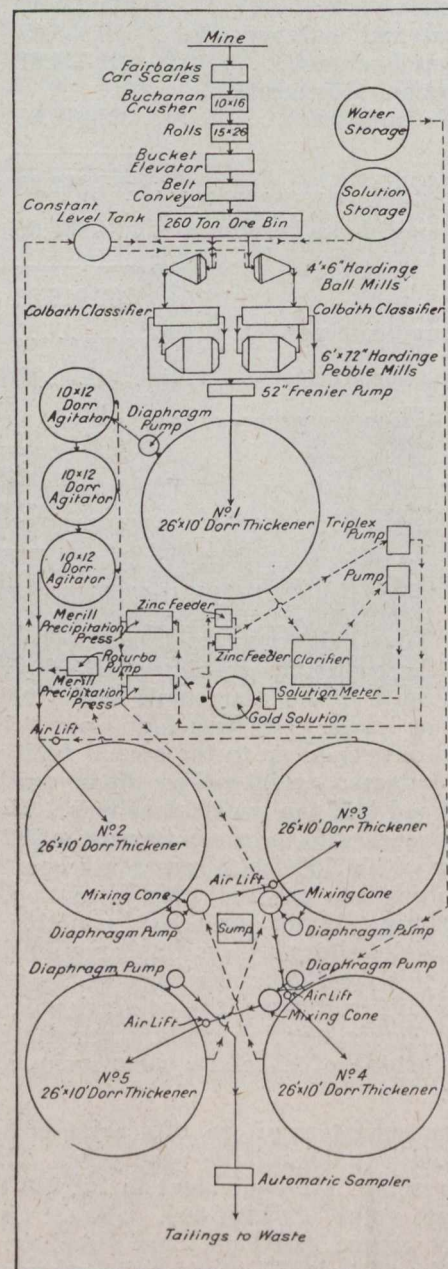
Gold bullion produced, 11,978.66 fine oz....	\$247,598.56
Silver bullion produced, 1,455.39 fine oz....	713.73
Total value recovered.....	248,312.29
Total value lost in tailings.....	21,355.13
Gross value of ore treated.....	269,667.42
Average value per ton treated.....	7.51
Loss per ton treated (tailings).....	.59
Recovery per ton milled.....	6.92
Extraction per ton milled.....	92.1%

The tonnage milled was drawn from the following sources:

	Tons.
Stopes.....	31,598
Development.....	4,077
Dump.....	224
Total.....	35,899

Distribution of Costs.

	Total.	milled. Per ton
Mining.....	\$76,743.96	\$2.14
Development.....	23,221.24	.65
Milling.....	55,477.33	1.54
Refining and marketing.....	4,382.96	.12
General.....	24,638.54	.68
Total operating.....	\$184,464.03	\$5.13
Head office, taxes, insurance, administration and interest....	12,455.31	.34
	\$196,919.34	\$5.47
Cost of 11,522 tons of ore broken but not milled.....	\$18,665.64	.52
		\$4.95



Flow Sheet, Vipond mill

The ore reserves on December 31st, were 90,000 tons, valued at \$587,280, of which 17,130 tons valued at \$93,000 were broken and stored in the stopes.

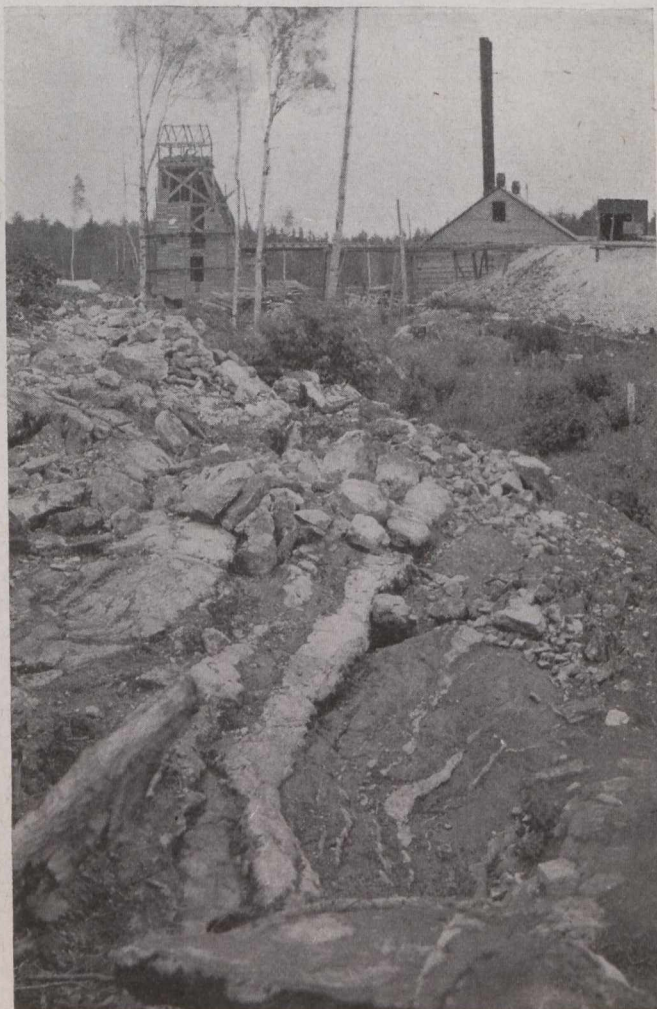
Additions to plant and equipment during the year amounted to \$15,794.97 and consisted of additions to

mill and refinery, mine pumps and equipment, additions to employees' cottages, stable and manager's residence.

The increase in the capacity of the mill has resulted in lowering costs from \$6.44 per ton in 1914 to \$5.47 in 1915, in spite of the fact that all supplies, especially chemicals and explosives have greatly increased in cost due to conditions brought about by the war.

Development has been kept well ahead of all requirements and the end of the year showed an increase of 11,522 tons of broken ore and 34,870 tons of developed ore over 1914, the total now being 90,000 tons against 43,608 tons at the beginning of the year. This in spite of the fact that during the six-week power shortage last spring, all development was stopped and it was necessary to draw the entire tonnage milled from broken ore reserves.

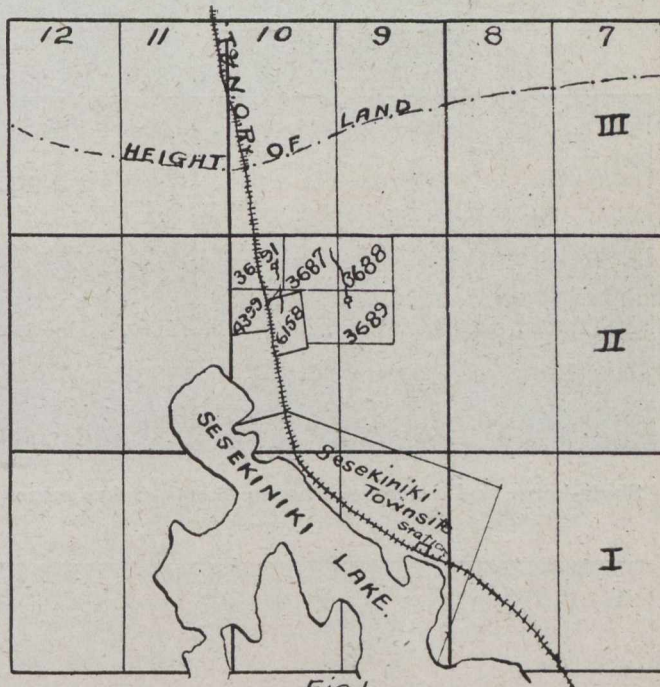
Due to the fact that a large proportion of the ore milled and developed during the year, came from the west end of the ore zone, between the 100 and 300-foot levels and that that section had been badly faulted, the grade of the ore treated and developed was lower than usual. This condition was caused by the inclusion of masses of waste rock, due to the faulting, which it was impossible to separate from the ore in mining. However, this condition appears to be local to the area above described, and future development will undoubtedly show ore of a higher grade.



Hollinger in 1910

SESEKINAKA

Very gratifying results have been obtained on the Howey, Cochenour and Randall claims about two miles east of Sesekinaka on Kapokita lake. Careful sampling of the veins uncovered shows very few blanks, and assays of the quartz vein which is three feet wide give values running from \$2.40 to \$136 a ton. Trenching has been carried on since November by four men. The



KIRKLAND LAKE

The Kirkland Lake district has one important producer of gold—the Tough-Oakes mine. Other properties in the district are now being energetically developed and there will be other producers before the end of the year. Prospects now idle will also receive attention. The districts looked promising a few years ago, but only one mine was brought to the producing stage and that one has been unfortunately the subject of



Shaft-house and compressor house, Tough-Oakes mine.



Tough-Oakes mill and cyanide plant, Kirkland Lake. □



New shaft-house at Teck-Hughes mine, Kirkland Lake.



McKane property, Kirkland Lake.

much litigation. Today, however, several properties are receiving attention.

The Tough-Oakes is a rich little mine; little compared with such mines as the Hollinger and Dome, but producing ore of higher grade. During 1915 there was milled 26,196 tons of ore, yielding \$21.04 per ton. The mill was started only in March, 1915, and the production in 1916 should be considerably larger than in 1915.

The Tough-Oakes ore is harder to mine and mill than most of the ore at Porcupine. Some of the orebodies are in comparatively soft greywacke and conglomerate; but a considerable portion is in a porphyry which has been found harder to drill and crush. Power and transportation facilities have had to be overcome and large expenditures on plant have been made. It is to be expected therefore that the cost per ton will not compare very favorably with the cost of mining and treating the large easily crushed orebodies of the Por-

cupine district. Nevertheless, a good profit is being made and distribution of dividends begun. The mill is described elsewhere in this issue.

The Teck-Hughes mine is nearing the producing stage. This property is now controlled by the Buffalo Mining Co. A 50-ton mill has been erected and is nearly ready for operation. It resembles the Tough-Oakes plant. The ore will be crushed in ball and tube mills and cyanided. Electric power will be used, but is not yet available. Recently underground work, suspended for a time, has been resumed.

The Lake Shore mine, on the shore of Kirkland lake, is operated by Mr. Harry Oakes. Development work has been carried on here with excellent results and recently high grade ore was cut at the west end of the 300-foot level. Several good shoots of ore have been opened by drifts at the 100 and 300-foot levels. The recent strike, if it proves of any length, will materially increase the quantity of known ore. The west drift had recently been in lean ground and the good ore was discovered by crosscutting a short distance, it being thought probable that the drift had not followed the main vein. The result of the crosscut makes this seem to have been the case.

Near the Teck-Hughes the Beaver Consolidated Mining Co., of Cobalt, is operating the McKane claims under option.

A few miles north of Kirkland lake, in the Goodfish lake area, operations are being carried on by La Belle Kirkland Mines, Ltd. This company took over the Gibson claims. A small plant was taken in during the win-



The Lake Shore Mine, Kirkland Lake, Ont.

ter, and development work is being carried on with good results. Mr. Frank Loring, of Toronto, is general manager.

There are other good properties at Kirkland lake and Goodfish which should receive attention. It is probable that some of them will be developed during the coming summer.

At Swastika, the stopping-off place on the T. & N. O. railway for Kirkland lake, are located the Swastika and Lucky Cross mines. The Swastika is at present idle. The Lucky Cross, after being idle for some time, is again in operation, the Trethewey Mining Co., of Cobalt, having taken an option on the property. The preliminary examination has proven satisfactory and work will be carried on steadily during the summer.



Stopeing with Waugh machine, Tough-Oakes mine, Kirkland Lake, Ont.

MILLER-INDEPENDENCE.

Cobalt, April 22.—The Miller-Independence Mining Co., operating at Boston Creek, has been bagging high grade ore for a considerable time, from the five test pits which have been sunk. The main shaft is now approximately 35 feet deep, and will be continued to the fifty-foot level, and a crosscut will be driven to catch the vein, which is dipping at an angle of about thirty degrees.

A Dodge crusher has been installed, which will crush the ore to three-quarter mesh and deliver it to the Nissen stamps.

The amalgamation will be done in the mortar block of the Nissen, after which the pulp will flow over an amalgamating plate and into a trap, and from the trap will be pumped into the concentrating cones, after which the concentrates will be bagged and shipped to the smelter.

The new electric lighting plant has recently been installed on the property, and the camps and buildings will be lighted with electric light.



Drifting with Leyner-Ingersoll machine, Tough-Oakes mine, Kirkland Lake.

The five-drill compressor which was recently installed is now running smoothly and it is the intention of the management to put on two shifts and push ahead the sinking of the main shaft.

While sinking one of the test pits last week, the richest ore yet found on the property was discovered.—Cobalt Nugget.

LA ROSE IN DELORO.

The La Rose Mining Co. of Cobalt is developing under option claims in Deloro Township. Mr. G. C. Bateman is in charge of the work.

BOSTON CREEK

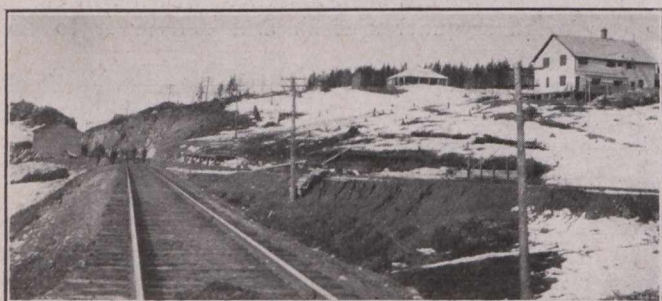
Boston Creek is a promising district in which important gold discoveries were made during 1915. It is easily reached by the T. & N. O. railway, one of the chief discoveries being less than a mile and another only a few miles east of the railway, at mileage 154, 51 miles north of Cobalt. A siding for freight has been

The R. A. P. Prospecting, Developing and Mining Syndicate, owners of several claims in the district, are operating the R. A. P. mine where good ore is being developed by shaft and drifts. The syndicate is composed of E. M. Richardson, W. B. Albright and J. K. Papasimakes, of New York.

The Miller Independence Co. is operating the McDonough claim. The vein has been tested by several



Boston Creek Station, Mileage 154, T. & N. O. Railway



Boston Creek Station and Inn



Boston Creek Inn



On the road to Miller-Independence mine, Boston Creek



On road to R. A. P. Mine. Boston Creek

constructed and the trains stop regularly. The Boston Creek Inn, located close to the station, is an admirable stopping place.

The indications are that there will be much activity in this district during 1916. At present three companies are operating.

shallow pits and a shaft is now being sunk. Mr. Miller, president of the company is very enthusiastic. He states that the work so far done has been very encouraging, gold being found in considerable quantity in all the openings. He has installed a small plant and a Nissen stamp and expects to be soon shipping concentrate.

The Crown Reserve Mining Co., of Cobalt, is developing under option the McCrea claims. A small plant has been installed and the sinking of a shaft begun. Encouraging results have been obtained.

The Ontario Bureau of Mines has nearly ready for publication a geological map of the Boston Creek district. Mr. A. G. Burrows and Mr. P. E. Hopkins examined the area last year and their preliminary report will soon be ready. Mr. Burrows will visit the area again this month.

Boston Creek is regarded by many who have examined properties there during the past year as very promising. Rich ore has been found on several properties. Development work now under way is meeting with good results. It is probable that the district will soon be a producer.



The R. A. P. mine, Boston Creek



The R. A. P. mine, Boston Creek



McCrea claim, Boston Creek



McCrea claim, Boston Creek

SCHUMACHER.

The Schumacher Gold Mines Ltd. was incorporated in 1914. The company operates the Schumacher mine which adjoins the McIntyre. F. W. Schumacher of Columbus, Ohio, is president. Mr. S. W. Wookey is manager, having succeeded Mr. Jos. Houston, who is now on the Dome staff.

The Schumacher is generally regarded as a good little mine. It is, however, not extensively developed and the amount of ore blocked out is small. A mill was constructed in 1915 and put into operation in October.

GOLD AT HALFWAY LAKE ?

The Pas, April 22.—A gold strike is reported at Halfway Lake, which is three miles off the Hudson's Bay Railway, at Mile 130. John Anderson, a rock fill contractor on the railway, says a bunch of Swedish railway men have staked 150 claims near the lake, though only a small number have been recorded.

SUDBURY.

In an article written for the Engineering and Mining Journal, New York, Mr. T. F. Sutherland, chief inspector of mines of Ontario, says:

"Sudbury is the greatest of Ontario's mining camps yet discovered, both in size of orebodies and their value. At the beginning of 1916 Sudbury was producing at the rate of \$48,000,000 in metals per year—\$38,000,000 in nickel, \$9,000,000 in copper and \$1,000,000 in gold, silver, platinum and palladium, based on the December, 1915, prices of refined metals. Seventy-one million tons of ore is proved in the Sudbury district, and while this is called a nickel ore and is mined primarily for its nickel contents, the tonnage carries in addition two billion pounds of copper and approximately \$60,000,000 in gold, silver, platinum and palladium."

GOLD ORE FROM MUNRO.

Matheson, April 22.—This week the Croesus started shipping high-grade ore. Two shipments have been made, but outside of that it contains a high gold content, nothing authentic could be learned. Last fall the company shipped a ton of ore that ran between 2,000 and 2,500 ounces in gold, or of a value of about \$45,000. It was the highest grade ore shipment ever made from northern Ontario. The high-grade ore from which shipments are now being made is coming from the 100 and 150-foot levels. The shaft is in the vein at 380 feet.—Toronto World.

GOWGANDA.

Elk Lake, April 21.—A promising looking patch of rich silver ore has been found by the Bishop Silver Mines at Calcite Lake, in the Wigwam district of Gowganda. The high-grade ore was found in the adit, 800 feet in.

GEOLOGICAL FEATURES OF THE PORCUPINE GOLD AREA*

By A. G. Burrows.

The Porcupine gold area, which for the past six years has held the attention of the mining public, is situated on the Hudson Bay slope of northern Ontario. The latitude of Niven's First Base Line of 1899, which forms the south boundary of Tisdale and Whitney townships is 48 deg. 27 min. 54 sec; consequently the area is somewhat farther south than the Canada-United States boundary in Manitoba and other western provinces. The camp is in the Timiskaming judicial district. Lying along the southern fringe of the great clay belt of northern Ontario, it adjoins a prospective farming country. In this belt many townships have been laid out in six or nine-mile squares and subdivided into concessions and lots; in the gold area itself and in the adjoining country to the north, many half lots containing 160 acres each have been granted to veterans as homesteads.

It is remarkable that the earliest discoveries at Porcupine have been developed into the largest producers. The outstanding mine is the Hollinger, named after its discoverer, Benjamin Hollinger. The discoveries on Pearl lake by Alexander McIntyre developed into the McIntyre mine, and that of John Wilson in the south-east part of Tisdale into the Dome mine. The large producing mines are all confined to Tisdale township, and the majority of these are in the vicinity of Pearl lake.

The principal towns of the area are Timmins, South Porcupine and Schumacher. The town of Timmins is most progressive, and is growing rapidly. The town is situated on a sand and gravel ridge overlooking the Mattagami valley, at an elevation of about 110 feet above the river.

To the northwest and west of Timmins a number of farms are being cleared along the Mattagami river. It is desirable to have a great part of the townships immediately north of the Porcupine gold area, which are in the clay belt, settled, as the farmers will have a near-at-hand market for their produce.

A branch line of railway connects the Porcupine camp with the main line of the Timiskaming and Northern Ontario railway. The line from Porquis junction to Timmins is 33½ miles in length, and the distance from Timmins to Toronto is 485 miles. When through trains are running the journey requires about 20 hours.

The First Prospecting.

In 1906 some work was done by prospectors on a vein near Miller lake and a few hundred feet from the present Hollinger veins. Evidently, seeing no gold, and having no assays made, they abandoned the property. In the same year claims were staked in Shaw township on what is described in the application as a "vein of sugar quartz and hematite iron." This is of interest since the so-called vein is simply the upturned edges of the Keewatin iron-formation.

In 1908 claims were staked by H. F. Hunter on the east shore of Porcupine lake. Gold was found sprinkled through the quartz and schist in a sheared zone.

It was not, however, until the following year that the spectacular discoveries of J. S. Wilson, on what is now the Dome property, caused a rush to the dis-

trict, and in a few weeks practically all of Tisdale and a great part of adjoining townships and unsurveyed territory were staked.

Since the discovery of gold in this area there have been repeated forest fires which have destroyed much timber. The worst fires in recent years occurred in 1911. About the middle of May of that year a fire completely destroyed the surface plant and buildings of the Hollinger mine.

The greatest fire of the year occurred on July 11th, when, after a prolonged dry season, a hurricane from the southwest brought up a fire. The surface workings and buildings of the Dome, West Dome, Vipond, Standard, Preston, East Dome, North Dome and several other properties were entirely destroyed by fire. The town of South Porcupine was completely wiped out, and almost all the part of Pottsville which escaped the fire of July 2nd. The north part of Porcupine (Golden City) was also destroyed. This fire was attended by a great loss of human life, 71 in all having lost their lives either by being burned, suffocated or drowned. The destruction of the surface plants by this fire retarded the production of the camp for almost a year.

Keewatin Rocks.

The rocks of Porcupine are largely igneous, and the greater part of them belong to the Keewatin. It is difficult to procure specimens of these old igneous rocks which are at all well preserved. In consequence, it is difficult, if not impossible, to make a close division of the Keewatin igneous rocks. Field evidence is abundant to show that the Keewatin is composed largely of volcanic rocks.

A great part of the Keewatin rocks is now altered to schist, and such terms as grey schist, green schist, hornblende schist, carbonate schist are used to describe certain rocks in various localities. These terms do not give much idea of the original mineral composition; for example, a grey schist may have been derived from a rhyolite or from a basalt. The terms grey schist and carbonate schist usually refer to a rock in which there is a high percentage of carbonate of lime, magnesia and iron. The rocks around the Hollinger mine, which are very much altered to schist, are referred to generally as grey schist. They contain considerable "carbonate," sericite, quartz and chlorite. An extreme alteration of an igneous rock to a schist is shown at the "blue" vein of the Millerton to the south of Miller lake. The ellipsoidal structure showing amygdules is still preserved, while the rock is a schist quite light grey in color and with a high percentage of carbonate.

Rocks which are probably alterations from basalts are of frequent occurrence in this area. They may now properly be called meta-basalts. A very striking rock is seen on the prominent hill east of the Hollinger mine. The ellipsoidal structure is very conspicuous, being readily recognized from a distance.

There is a series of rocks outcropping in the southwest portion of Whitney, in most of Shaw and the greater part of Deloro township which differs greatly from those which form the large part of Tisdale township. This series consists of fine-grained greyish and greenish schists, some of which show water-sorted

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

bands, rusty weathering carbonate, iron formation, agglomerate, ash rocks, pillow lavas and other igneous rocks. The series contains a high percentage of fragmental rocks, in which respect it is different from the volcanic series in Tisdale. The bands of iron formation occur at different horizons in this series.

A number of green dikes are associated with these rocks throughout Deloro and Shaw. These are usually less than 100 feet in width and they cut the banded iron formation. The rock is completely altered, the predominating mineral being chlorite which gives the green color to the rock.

Iron formation outcrops frequently in the southwest portion of Whitney township and also in Shaw and Deloro townships.

In various parts of the area associated with Keewatin rocks are carbonates to which various terms have been applied, such as: dolomite, ferro-dolomite, ferruginous carbonate and ankerite.

Two series of sedimentary rocks later in age than the Keewatin occur in the Porcupine area. Of these, the older is the Timiskaming series, which is of great importance, while the younger is the Cobalt series, which is unimportant.

The Timiskaming Series.

This series of rocks is prominent in the townships of Tisdale and Whitney. It is traceable by means of infrequent exposures from the vicinity of the Dome mine to the north shore of Night Hawk lake. To the east of Night Hawk lake the country is heavily drift-covered. Sedimentary rocks similar to those of Porcupine are seen in Beatty and Munro townships, which lie to the east of Matheson station, about 40 miles from Porcupine, and again at Kirkland lake where many of the gold-bearing veins occur in schistose conglomerate and greywacke. The rocks of the series are in areas which have their greater dimensions in a general east and west direction, as will be seen from the maps of the Porcupine and Kirkland Lake areas.

The Timiskaming series consists of conglomerates, interbanded slate and greywacke, and quartzite. The rocks for the most part have been altered to schistose derivatives. The beds are in a highly inclined attitude varying from about 70 degrees N. to vertical. The general strike of these beds around the North Dome and nearby properties is about N.E. and S.W. The cleavage planes are quite clearly shown to intersect the bedding planes and are in a more nearly east and west direction. Where the slate-greywacke rocks occur, the original bedding is quite plainly recognized in the alternate dark and light-colored beds. This sedimentary structure is well shown around the North Dome. Here the slate-greywacke beds are lying against a bed of conglomerate about 200 feet in thickness.

The sedimentary rocks at the Dome mine have been greatly altered, occurring as they do along a sheared zone impregnated with quartz. In the large open pit at this mine the fragmental character of the rock can be observed, particularly along the south edge where the rock is a conglomerate. In this conglomerate there is considerable variety of included fragments, such as greenstones of varied types, light-colored quartz-porphry, felsite, sugary iron formation and quartz. The matrix of the conglomerate is now quite schistose, and in some of the freshly broken rock, unless light-colored fragments are present it is difficult to recognize the conglomerate character. To the east of the main hoisting shaft there is some extremely fine-grained slaty

rock which breaks in fissile slabs. This same rock is observed in the easterly workings of the mine.

The rocks of the Timiskaming series have been greatly impregnated with carbonate solutions, so that many of them are now largely carbonate, effervescing freely with acid. In this respect these rocks differ from those of the Cobalt series, which are on the whole fresher and harder rocks.

While there is much evidence pointing to a separate sedimentary series of rocks, the possibility of some of what has been called Keewatin being contemporaneous with the Timiskaming, or of some of the sediments being of Grenville age must be considered. Toward the southwest from the open pit at the Dome mine there is a narrow band of conglomerate which has been mapped as Timiskaming. Much of the material in this band, immediately north of the readily recognized pillow lava and amygdaloidal rock, resembles volcanic fragmental or agglomerate. There is no break, however, between the apparent volcanic fragmental and the interbedded slate and greywacke which occurs along the south margin of the open pit and which can be followed northward for a mile. If the rock above mentioned is a volcanic fragmental and not a true conglomerate deposited on an eroded surface, then there is reason for considering the pillow lavas, fragmental rocks, slates, greywacke and conglomerate as belonging to one series. For lithological reasons it seems preferable to consider the large area of sediments as a separate series. Economically the series of sediments has the same importance as the volcanic series, since it has been subjected to the same gold-bearing vein influences.

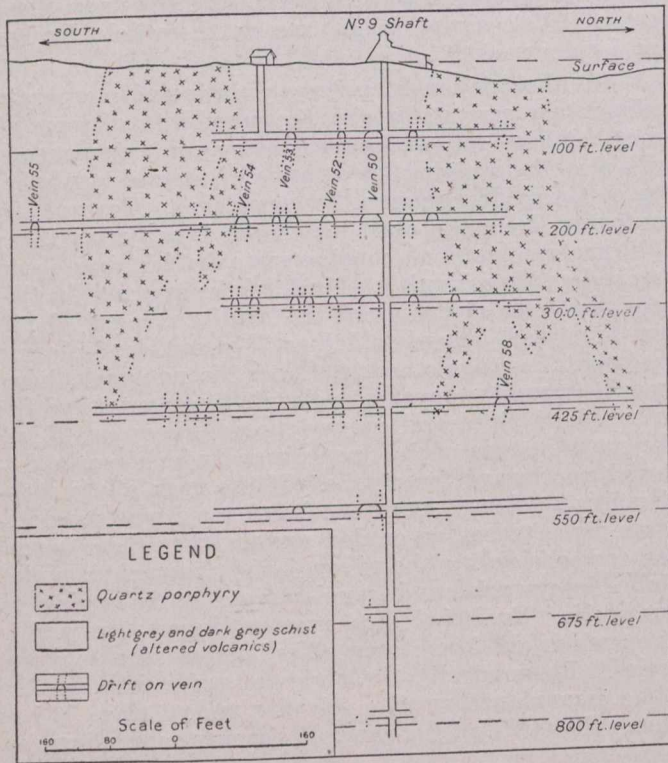
Porphyry.

An intrusive rock, generally of a light grey color, occurs in many parts of the Porcupine area. It is readily recognized in the field by its light color, coarseness of grain, frequent phenocrysts of glassy quartz, and white and bleached phenocrysts of acid plagioclase. In most localities it has been altered to a schist, particularly in the vicinity of the McIntyre, Acme and Dome mines, but, even when very schistose, it is readily recognized. The rock is quite prominent to the southwest of Pearl lake and to the south of the Dome mine. It occurs sometimes as definite dikes, as at the Dome Extension, where dikes only twenty or thirty feet in width are traceable across a claim. The usual occurrence is in broad, irregular masses which have been exposed by erosion. The outcrops of the porphyry in the vicinity of the Hollinger are elliptical in shape. It is quite likely that other masses occur throughout this area which have not yet been exposed by erosion.

The porphyry is of a light greyish to greenish color. Microscopical examination of the porphyry from numerous places proves it to be fairly uniform in mineral composition. The phenocrysts are quartz and feldspar. Of these the feldspars are much more numerous, and are partly altered to secondary minerals. The ground-mass consists of quartz, feldspar, carbonate, sericite, chlorite and pyrite.

Important gold deposits have been found near the contacts of the quartz-porphry and other rocks in Tisdale township, but the contacts of the porphyry and other rocks throughout Whitney and Deloro have not shown ore deposits, although such may be found. It would appear that the intrusions of quartz-porphry at different parts of Tisdale have in some way influenced the deposition or location of the gold, but it is not likely that the porphyry has been the source of the

gold-bearing solutions. The porphyry has been subjected to extreme alteration in the zone of vein formation, and has been greatly contorted before the formation of the quartz deposits, which frequently occur in the porphyry as veins or replacements.



A North and South vertical section across the vein system of the Acme mine, illustrating the "chonolith" form assumed by the quartz-porphyry

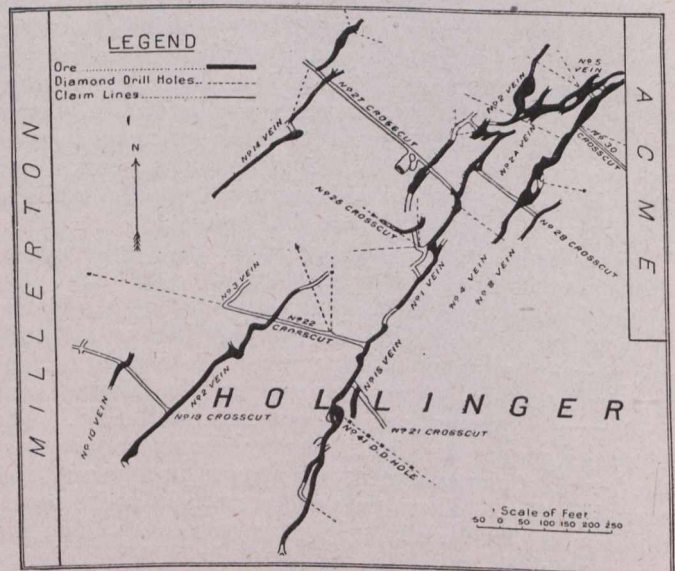
Character of the Gold-Bearing Deposits.

All the gold deposits at Porcupine are believed to belong to the same period of ore deposition. They occur in rocks of Keewatin, Timiskaming, pre-Algoman and Algoman age, while the mineralization was probably in Algoman times. Some writers on this area have attempted to make a classification based on structural resemblance in certain of the deposits. It may be said that each deposit has peculiarities of its own, but that in general there are characteristics common to all. For example, all the deposits will in parts show such structures as simple vein, lode, irregular masses of quartz, and mineralized schist. These structures are largely dependent on the character of the enclosing rock, whether schistose, greatly foliated, or massive. Some deposits have been formed near the contact of the quartz-porphyry with other rocks, but this feature is not sufficient in itself to warrant such deposits along contacts being classified separately. For example, at the Dome mine the deposit exposed in the large open pit is considerably north of the contact and in the conglomerate and slate, whereas a deposit underground to the south of No. 2 shaft and only a few hundred feet away has the quartz-porphyry as the hanging wall.

The irregular fissuring has produced a great variety of quartz structures, varying from the tabular, though often irregular or lenticular, vein which may be traced several hundred feet, to mere veinlets, often only a fraction of an inch in width and a few feet in length, which ramify through a rock that has been subjected to small irregular fissuring. This latter variety is well

illustrated in the fissuring of ankerite bands, so characteristic of some of the gold deposits of Porcupine. Irregular and lenticular bodies of quartz often occur which may have a width of ten or twenty feet, but which die away in a distance of fifty feet. Again, there are dome-like masses of quartz which are elliptical or oval in surface outline. In some parts at least these masses can be seen in contact with underlying rocks at a low angle, which would suggest that they are broad lenticular masses which have filled lateral fissures in the country rock. The most conspicuous dome masses were those of the Dome property, where the two largest were about 125 feet by 100 feet. A fissure may be vertical and irregular at some points. At others it may incline at a lower angle to the horizontal or take on a more or less lenticular form.

The term "vein" as used here is not confined to the filling of a single fissure with well-defined walls, for this type of vein is rather the exception in the Porcupine area. The fissuring has been so irregular that a "vein" in one part may consist largely of quartz, and in another part of numerous veinlets of quartz and intervening schist, greatly resembling a stockwork; again, the main part of a vein may be almost vertical in attitude, but many veinlets, as branches from the main vein, may extend laterally into the country rock. It is often found that the values are obtained in parts of the vertical vein which have been subjected to a later movement and enrichment, whereas the lateral veins have little or no value. This is illustrated in the No. 1 vein at the Rea mine.



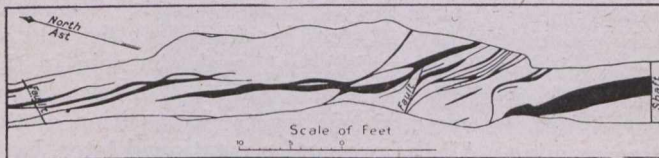
Plan of the 200 foot level, Hollinger Gold Mines, Limited

The relationship of the strike of the veins to that of the enclosing rock is often difficult to determine, since generally along the veins there has been shearing of the country rock which may conform to the general direction of the strike of the veins. However, by determining numerous strikes in the schist away from the veins, it is seen that the majority of them are inclined to the strike of the enclosing rocks. In dip the veins vary from vertical to nearly horizontal. In No. 1 shaft of the Hollinger the vein is practically vertical, while a series of narrow quartz veins, 6 to 18 inches wide on the Lindburg claim, have a dip at the surface of only 20 degrees. The prevailing dip of the schist in the Porcupine area is to the north at a high angle, and frequently the veins dip distinctly to the south across

the cleavage of the schist. While it is apparent that most of the deformation of the country antedates the vein formation, nevertheless there is a decided tendency in many cases for the fissuring to be influenced by the direction of schistosity, which is also a direction of weakness; hence we find veins having a more or less lenticular structure, the strike of which closely corresponds to that of the country rock.

It will generally be found that where the lenses are broad the schistose wall rock is approximately parallel with the lens; whereas the narrow portions of vein between lenses frequently cut across the schist.

Lenticular veins occur chiefly where the country rocks have been intensely sheared or rendered schistose, as around Pearl lake. Usually when there has been less disturbance the veins are more likely to have a marked difference in strike from the enclosing rock—as around Three Nations lake and the porphyry area south of Simpson lake. It may be stated that the larger and usually lenticular veins of the area occur where the rocks are extremely schistose, while the narrower, better defined veins occur as stringers from these main lenticular veins, or in less disturbed areas.



Plan of the 50-foot level, Porcupine Pet, H.R. 907, Deloro Township, showing the reticulated structure of the auriferous quartz veinlets in the quartz-porphyry.

The quartz-porphyry on the Preston, Fogg (L.O. 325) and other claims in Deloro township along its north boundary is more massive than that near the Dome or around Pearl lake, while the greenstone is also much less altered to schist than in other parts. Consequently the veins are narrower and have not the lenticular structure so characteristic of those deposits at Porcupine which are in schistose rocks. Most of these veins have a strike nearly north and south across the mass of

solutions, difficulty has been experienced in finding ore-bodies of commercial importance.

Distribution of Veins.

While gold-bearing veins occur over a wide area and are often isolated, it is seen, from a number of those already discovered, that they occur in groups along certain lines. For instance, in Tisdale township there are at least three distinct areas where the fissuring has been most pronounced. One such area extends from the southeast end of Miller lake, on lot 11, in the second concession, in a northeasterly direction for three miles, and includes such veins as the Porcupine Crown, Millerton, Hollinger, Acme, McIntyre, Jupiter, Rea, and in addition others with visible gold. The average strike of the veins here is northeast and southwest. An exception is a vein on the Porcupine Crown, which strikes north and south.

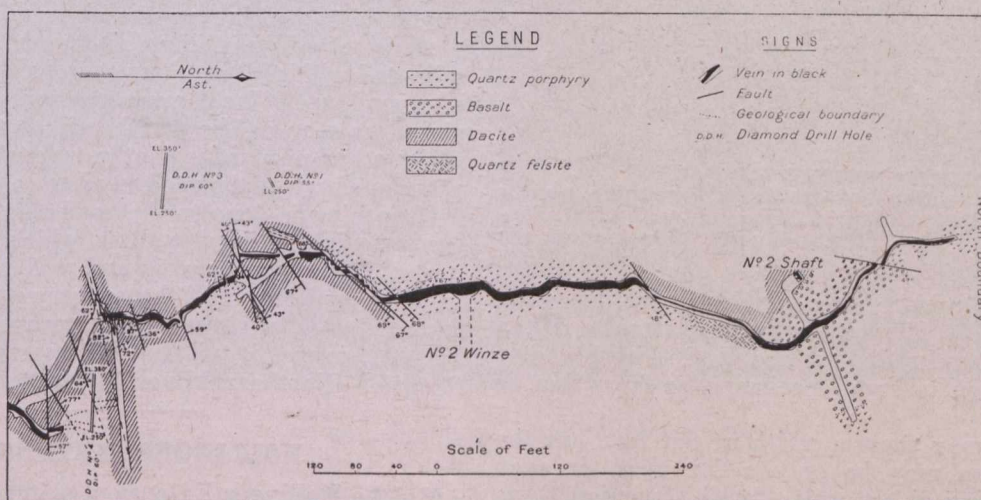
Another series, including the Smith, Davidson, Crown Chartered and Dobie, occurs in the northeast part of the township. To these should be added the Scottish Ontario, Mullholland, Hughes and Gold Reef, which are in the northwest part of Whitney township. The general direction of these veins is east and west.

Again, in the southeast part of the township is a group including the Dome Lake, West Dome, Dome and Dome Extension, with a general strike north of east.

Occurrence of the Gold.

A field examination shows that there is an irregular distribution of the gold in the quartz veins. Very often it occurs along dark streaks in the quartz, along the contacts of quartz and schist, or around patches of dark colored mineral in the quartz. At the surface, rich portions of veins are often indicated by rusty streaks or patches, while at depth the rusty character gives place to dark grey, black or greenish colors.

Under the microscope the gold is generally found in areas which have been greatly crushed or in the quartz or schist bordering on these areas.



Plan of the third level (300 feet) Porcupine Crown mine, showing geology and intricate block and step faulting to which the vein has been subjected. The reproduction is from plan furnished by M. W. Summerhayes, manager.

quartz-porphyry. They lack the banded structure so frequently seen in the Pearl Lake area. Coarse gold associated with zincblende and pyrite occurs in some of the narrow veins, many of which are only a few inches in width. Owing to the narrowness of these rich veins, and the massive character of the porphyry rock which shows little impregnation with gold-bearing

The prominent minerals which occur in the crushed areas are pyrite, calcite, dolomite, sericite, chlorite, tourmaline and quartz. It is thought that most of the gold has been deposited along with pyrite from the impure solutions which circulated in the minute fissures and crushed areas of the primary quartz of the veins. The quartz of No. 1 vein of the Hollinger mine shows

numerous dark streaks in parts of it and often across the width of the vein. These are generally short and irregular in distribution. Iron pyrites and often galena occur with the gold. Microscopically, the quartz occurs in fairly large grains, contains liquid and gas inclusions and has been subjected to secondary pressure and granulation along the margins of the grains. The iron pyrites often occurs in well-shaped crystals which have been formed subsequent to the crushing. These fine dark streaks may have resulted from a solidification and shrinkage of the quartz forming filmy cracks, which may have become slip or crushing planes along

showed grains of gold apparently enclosed in the primary quartz, but the occurrence is much less prominent than where gold occurs in the crushed areas.

It is important to note that practically all the veins which are gold-bearing contain considerable carbonate of varied composition. Wherever the enclosing rocks are of schistose they always carry carbonate.

MUNRO TOWNSHIP

While the road into the Munro township goldfields is now in such a condition that it is hard to get in supplies save at night when the frost has stiffened the mud, there is every indication that there will be much activity in the townships of Munro, Beattie and perhaps Bowman.

It is upon the success of the Croesus that everything turns, and it is narrowly watched. The plant at the Croesus is now complete with the exception of the headframe, which was started this week. At the 100 and 150-foot level some of the high grade is being broken down and two shipments of bullion have been made to Denver—one during the past week. The shaft is being sunk to the 400-foot level, and at the end of last week it was down 340 feet, with the vein in the bottom of the shaft. All location in the district is announced in the camp in relation to the position of the Croesus mine. All the properties mentioned later, have some free gold, although there is little work done.

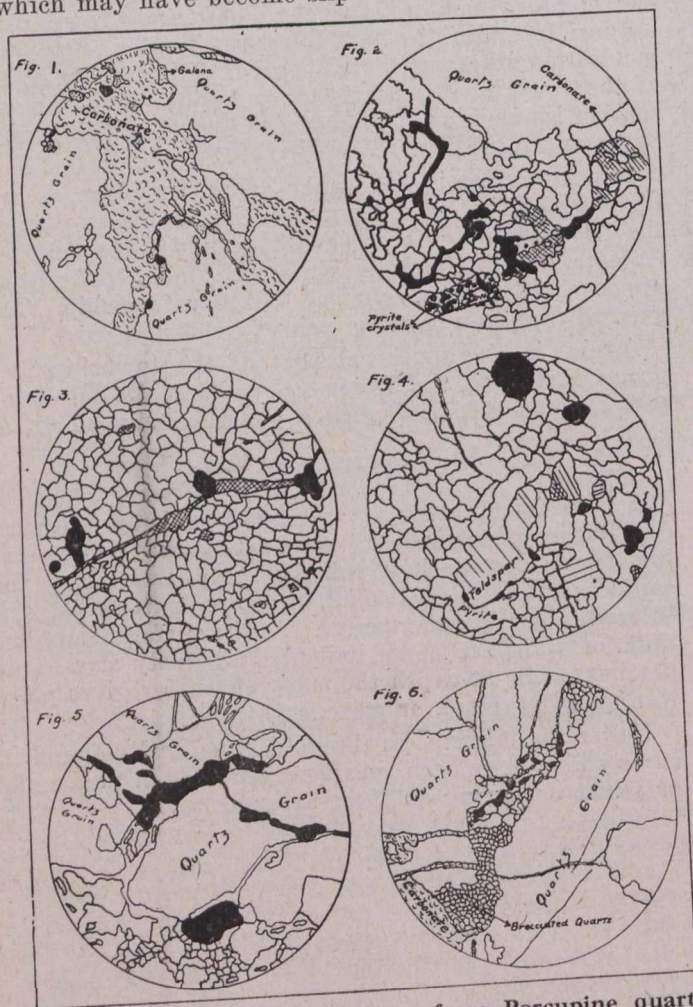
On the Falkenham property, north of the Croesus, a shaft is being put down. Mr. E. A. Taylor, of Toronto, is sinking a shaft on the Daniels veteran claim about a mile and a half east of the Croesus. The shaft is now down about 25 feet. Mr. Mickle, of the firm of Mickle and Dymont, of Barrie, is putting up camps on a claim in Beattie and preparing to sink. Mr. John McLaughlin, whose property is situated about three-quarters of a mile east of the Croesus, is sinking in the porphyry.

Mr. Chas. Miller, of Toronto, who is the president of the Burton mines, says that his company will certainly do something on the claim this year, although there is actually nothing doing now. The Munro Consolidated will start work as soon as the Hairston estate is wound up. The Brown veteran claim will be explored as soon as the weather is better, and there are many other properties that were staked last year but abandoned when the road became so bad.

If nothing is done to the road this spring it will degenerate into a mud wallow which will make transportation most expensive and will have the effect of keeping capital out of the country. It will be difficult enough to travel if the summer proves to be a dry one, but if it is wet it will be the worst road in Northern Ontario.—Northern Miner.

HOLLINGER EXTENSION.

On the Hollinger Extension, about 300 feet from the northeast corner of the Vipond, the Canadian Mining and Finance Co. are now sinking shaft No. 14. At the 425-foot level a crosscut 2,500 feet long will connect this shaft with the central deep working shaft near the southwest corner of the Acme and consequently with the extensive workings on that property and on the Hollinger and Millerton. Shaft No. 14 is in the zone of coarse-grained siliceous lava as lately mapped by A. G. Burrows, and extending across the Acme, Hollinger Extension and Porcupine Success.—Cobalt Nugget.



Drawings of thin sections of ore from Porcupine quartz veins. Fig. 1, Hollinger. Fig. 2, Dome. Figs. 3 and 4, Porcupine Lake. Fig. 5, Rea. Fig. 6, Vipond. Black spots are native gold.

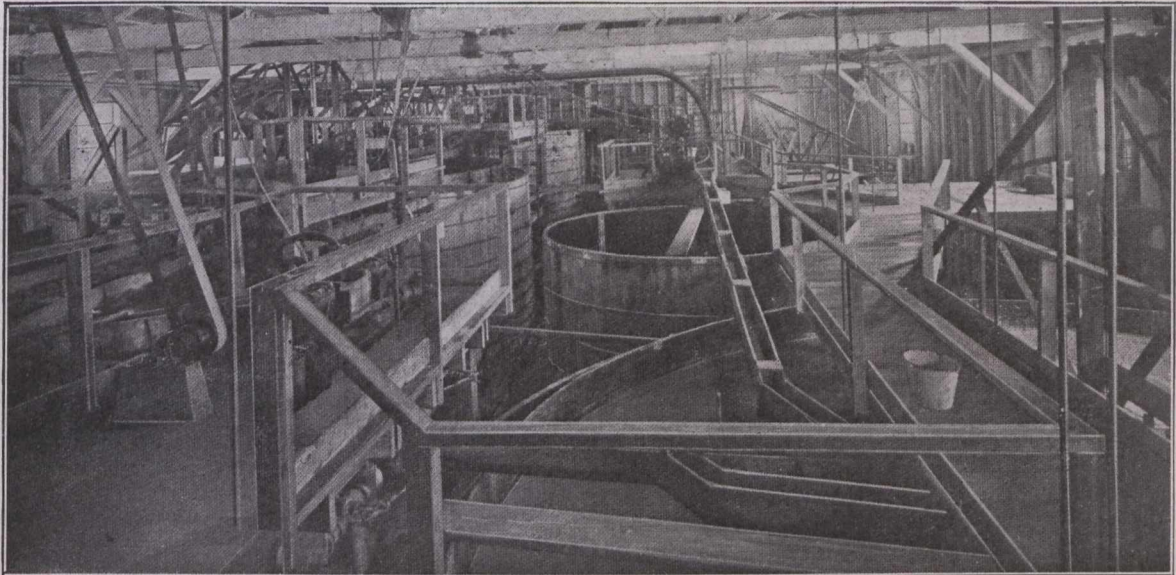
which the richer gold-bearing solutions were deposited at a later period. These minute dark streaks in the quartz are frequently slickensided, and this character may often be seen in hand specimens, as from Rea or Vipond mines.

Often a vein may show a width of ten feet, but the fractured portion may be only a few feet, or even inches, wide along either wall. In this portion there may be many streaks of dark mineral which are often parallel, giving a banded character to the ore, as in many of the veins in the north part of Whitney and Tisdale, namely, at the Mullholland, Scottish Ontario, Davidson and adjoining properties. A similar banded structure is seen at the Rea mine. At these properties tourmaline is the principal mineral of the streaks. The gold may occur along these lines or in the intervening quartz, which is often much crushed and filled with later minerals. Several sections were examined, which

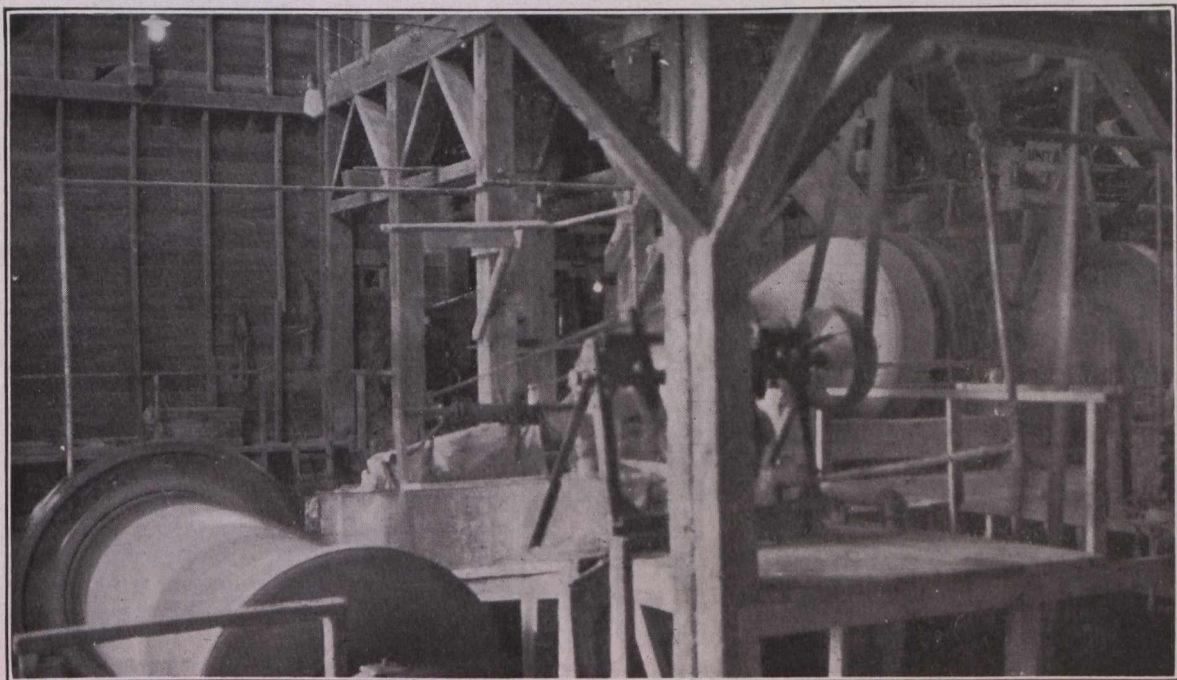
THE TREATMENT OF PORCUPINE GOLD ORES

Porcupine, being the most important gold district discovered in recent years, has received the attention of many of the best metallurgists. From their studies it was soon evident that the ores would be comparatively

suitable for treatment by the process became a more important factor amalgamation was discarded. The first Hollinger mill was destroyed by fire before it was completed. The McIntyre and Vipond mills were shut down after being operated for some months. The Hollinger, McIntyre and Vipond now use the cyanide process.



Porcupine Crown cyanide plant



Ball and tube mills, McIntyre plant

easy to treat. The ores are very easily crushed, a considerable portion of the gold in some of the ore is readily recovered by amalgamation and the gold not easily won by amalgamation can be recovered very economically by cyanide treatment.

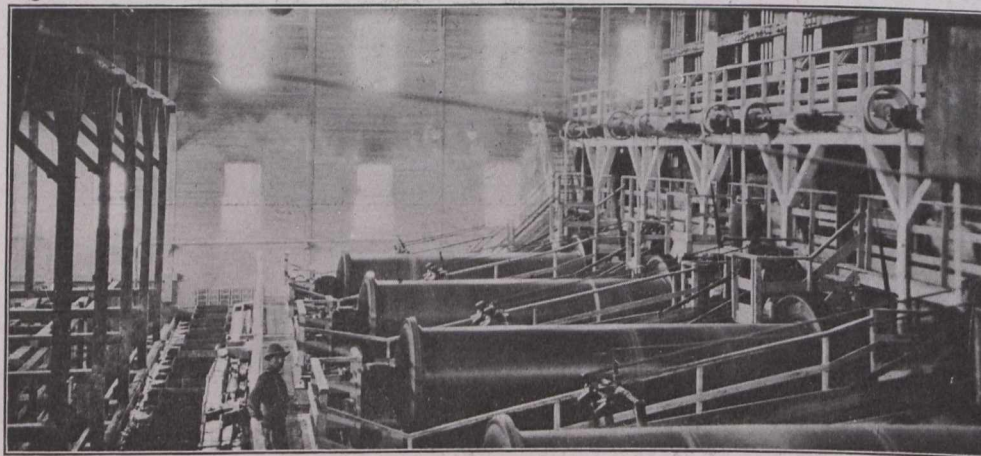
In the mills first built amalgamation played an important part in the treatment. Hollinger, McIntyre and Vipond all had small mills in which amalgamation was the chief method of recovering the gold. These proved satisfactory for some of the ore, but as ore un-

At the Dome, cyanidation has been used from the start. At first the ore was passed over plates before fine grinding, but later the primary plates were discarded. At present amalgamation is used in treating concentrates from cone classification of the tube mill product.

Present practice at Porcupine is to crush the ore by stamps or ball mills and recrusher in tube mills. The primary crushing in most cases is done in solution. Dome, Hollinger and Porcupine Crown use stamps. Me-

Intyre and Vipond use ball mills. Ball mills and stamps give splendid results. The ore can be easily crushed with either. There is, however, considerable difference of opinion as to the relative merits. Many express themselves in favor of ball mills. The McIntyre has certainly obtained excellent results from their use. On the other hand the stamps have done good work. Apparently the available data is not of a character to justify a change being made in existing plants nor is it even conclusive enough to lead to an easy decision on the part of those who are planning new plants and additions. At the Dome and Hollinger ball mills have been installed as an experiment. The results obtained in the next few months from these tests will undoubtedly have considerable influence on the design of new plants for the treatment of such ores.

Next to the crushing problem, perhaps the most interesting feature of Porcupine metallurgical practice just now is the adaptability of continuous counter-current decantation. The process has proven very successful.



Tube mills, Hollinger plant.

Last year Mr. Noel Cunningham presented a paper at the Toronto meeting of the Canadian Mining Institute on "Metallurgical Practice in the Porcupine District." The following are extracts from his paper:

"Character of the Porcupine Ore.—There is no oxidized ore in the district, the surface having been deeply planed by glacial action in recent geologic time. The precious metal content is about in the proportion of 85 of gold to 15 of silver by weight; hence, the silver is practically negligible. There are two classes of Porcupine ore, having very different characteristics; these will be referred to throughout this paper as Class A and Class B.

"Class A ore is a pure quartz with inclusions of schist. Generally it is heavily fractured and breaks down readily to sharp, hard grains, about minus 10 plus 20 mesh, requiring further comminution to release the gold. It carries very little pyrite; the gold is entirely free and apt to be coarse, but often spongy, going into solution readily on that account. This gold is 60 per cent. to 85 per cent. free milling, depending on the grade of ore.

"Class B ore is a schist, strongly laminated, carrying 4 to 5 per cent. pyrite; its specific gravity is 2.8 to 3.0, depending upon the amount of mineralization. In breaking the ore in the mine, generally over 25 per cent. of material through a 1/2-inch ring is made; the ore readily breaks down in milling and makes a comparatively large amount of non-crystalline slime; ow-

ing to its high specific gravity, however, it is quick settling. In my opinion, the gold in this ore is free, but so finely divided that it will neither pan nor amalgamate; it appears to be disseminated through the rock and not chiefly associated with the pyrite.

"Mill Design.—The proper design for a mill treating Porcupine ore will depend upon the proportions of Class A and Class B ore to be handled. Unless there is to be a large excess of Class A ore, amalgamation may be dispensed with, as the recovery by amalgamation will not warrant its use. If Class A ore is in large excess it would still be an open question, but from a recovery standpoint amalgamation is unnecessary.

"The Hardinge ball mill may not show up as well on Class A as on Class B ore, but I am inclined to think that it would. With an excess of Class B ore the ball mill will be superior to stamps. I am of the opinion that a cylindrical tube mill should be used for fine grinding, rather than a conical mill, if only for a theoretically better dissolution of coarse gold. For the treatment of any considerable proportion of Class B

ore, table concentration, with separate treatment of the concentrates, will probably pay.

"Agitation should be arranged to be continuous, preferably in a series of flat-bottomed agitators, allowing a preferential treatment for the quicker-settling portion of the ore. If filtration is used, a pressure filter will be more satisfactory than a vacuum filter; however, the ore is so perfectly adapted to continuous counter-current decantation that this would seem to be the proper treatment.

"On account of the severe winter conditions and the high cost of fuel, the object to strive for in the design should be as compact an arrangement of the equipment as possible, so as to minimize the cubic area of buildings to be heated. In the district, the water supply is ample, the sites for mills are good, and the facilities for convenient tailing disposal are adequate."

CHAMBERS-FERLAND.

In running a crosscut from the winze on the Chambers-Ferland at the 425-foot level what is undoubtedly an extension of one of the veins of the Meyer system has been cut. It is from two to four inches of very high grade ore where it is cut about 180 feet from the winze, but it is right on a fault and some development will have to be done before its importance can be accurately defined. At the point struck it is about 59 feet from the Nipissing line. The discovery at its present stage of development is of much promise.—Northern Miner.

METALLURGY AT TOUGH-OAKES GOLD MINES, LIMITED

By Chas. A. Randall.

The Tough-Oakes Gold Mines, Ltd., is the chief producer in the Kirkland Lake gold mining area, which is about 60 miles north of the Cobalt silver mining district, in the Province of Ontario. The plant for treatment of the ore is one of the most recently constructed in Ontario. It has now been in continuous operation over one year.

During May, 1913, a small amalgamation mill was put into operation, primarily for producing revenue from that portion of mine ore which was not shipped to smelters direct. The small mill, consisting of five stamps and an amalgamation table, was subsequently increased in size by the addition of a Hardinge pebble mill. This amalgamation mill was operated until March, 1915, and gave an average recovery of about 50 per cent.

In May, 1914, metallurgical experiments were begun for the purpose of deciding upon the most suitable type of cyanide plant for handling the average run of mine ore. The following tests are representative of results obtained, and indicated that with a grinding of ore product 75 per cent. to pass a 200-mesh screen, and an agitation in cyanide solution of twenty-four hours' duration, it would be possible to get an extraction around 94.5 per cent.

Amalgamation tube mill and tank agitation test on 40 pounds of stoping ore, principally porphyry and quartz.

In this test the concentrates were not separately ground to pass 200-mesh, but were separated from bulk of ore, sampled and then added to the sands subjected to tube mill treatment. Old precipitated solution, having a head value of 1.45 pounds KCN per ton of solution, was used.

Assay heads of ore under treatment, \$41.40.

Assay head sands and concentrates to tube mill, after amalgamation, \$16.20.

Assay tails tube mill, \$6.40.

Extraction on \$16.20 head, 60.49 per cent.

Head assay slimes (to tank 1 hour), after amalgamation, \$18.30.

Tails assay slimes (to tank 1 hour), \$3.80.

Extraction on \$18.30, 79.82 per cent.

Calculation of composite heads to grinding circuit:

63% (sands and concentrates) \$16.20 = \$10.20

37% slimes (to tank 1 hour) 18.30 = 6.77

\$16.97

Calculation of composite tails from grinding circuit:

63% tube mill tails \$6.40 = \$4.03

37% slimes tails (1 hour) 3.80 = 1.41

\$5.44

Assay original heads \$41.40

Assay to grinding circuit 16.97

Extraction by amalgamation \$24.43 = 59%

Grinding circuit head \$16.97

Grinding circuit tail 5.44

Cyaniding extraction on \$16.97 head . . \$11.54 = 68.8%

The following table shows results by taking samples from discharged air lift:

Time, Hours.	Tails Assay from Air Lift.	KCN used per ton.	Cyanide extraction
			on \$41.40 Head. Per cent.
0	\$5.44	.54	87.10
1	4.40	.75	89.37
4	2.40	.9	94.20
7	2.20	.9	94.68
10	2.00	.95	95.17
13	1.90	.95	95.41
20	1.90	.95	95.41
24	1.80	1.1	95.65
30	1.80	1.1	95.65
Final residue	2.30	1.1	94.44

Screen tests:

Original ore—	Per cent.
On 80 mesh.	29.2
On 100 mesh.	12.5
On 150 mesh.	7.4
On 200 mesh.	12.2
Through 200 mesh.	37.2
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	98.5

Head Assay \$41.40

Final residue—	Per cent.
On 150 mesh.	6.5
On 200 mesh.	15.4
	<hr/>
	77.3
	<hr/>
	99.2

Tube mill and tank agitation test on 60 pounds sample of stoping ore averaging about three-fourths porphyry and one-fourth greywacke and conglomerate, and some quartz.

Ratio of ore to solution in tube mill, 1 to 1½.

Heads assay sands to tube mill, \$36.20.

Tails assay residue from tube mill, \$5.40.

Tube mill extraction, 80.51 per cent.

Ratio of slimes (to tank 1 hr.) to solution, 1 to 4.

Head assay slimes, \$48.40.

Tails assay slimes, \$4.20.

Extraction, 91.70 per cent.

Pounds of sands to tube mill, 30.

Pounds of slimes to tank, 30.

Heads assay combined sands and slimes, \$42.30.

Tails assay combined after above treatment, \$4.80.

Overall extraction after above treatment, 88.65 p.c.

Screen tests:

Sands to tube mill, 30 lb.—	Per cent.
On 60 mesh.	7.8
On 80 mesh.	66.2
On 100 mesh.	23.4
Through 100 mesh.	2.4
	<hr/>
	99.8

Assay value \$36.20

Slimes to tank, 30 lbs.—	Per cent.
On 100 mesh.	29.0
On 150 mesh.	2.3
On 200 mesh.	3.6
Through 200 mesh.	65.0
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	99.9

Assay value \$48.40

Combined sands and slimes before treatment—

	Per cent.
On 60 mesh.	3.9
On 80 mesh.	33.1
On 100 mesh.	26.2
On 150 mesh.	2.3
On 200 mesh.	1.8
Through 200 mesh.	32.5
	<hr/>
	99.8

Combined sands and slimes after above treatment subjected to 24 hour agitation with paddles and air lift.

	Per cent.
On 150 mesh.	8.2
On 200 mesh.	7.0
Through 200 mesh.	84.4
	<hr/>
	99.6

Assay value of ore heads, \$42.30.
 Assay value of final residue, \$2.10.
 Overall extraction, 94.90 per cent.

The following table shows the results obtained from samples taken from discharge of air lift during the 24 hours' agitation period.

Hours.	Assay value residue.	KCN used per ton ore—lb.	Overall extraction Per cent.
0	\$4.90	.8	88.65
3	3.40	1.1	91.09
6	3.20	1.1	92.43
9	3.00	1.2	92.90
12	2.70	1.3	93.61
16	2.20	1.4	94.80
24	2.10	1.5	95.04

Strength of KCN solution used, 1.5 lbs. per ton solution.

Specific gravity final slimes, 2.7.

Rate of settling, 500 c.c. graduated cylinder used:

Clear Solution.	Time.
10 per cent.	2 minutes
20 "	3½ "
30 "	5 "
40 "	9 "
50 "	14 "
55 "	21 "
60 "	25 "
65 "	30 "
70 "	45 "
75 "	85 "

Concentration, tube mill and tank agitation test on 40 pounds of stoping ore, principally porphyry and quartz.

After concentrating, all sands coarser than 200 mesh, amounting to about 63 per cent. of the whole charge, was given tube mill treatment. The 37 per cent. under 200 mesh was passed to agitation tank direct. In previous tests of this series all on 150 mesh was passed to tank direct. In panning concentrates all heavy sands which tended to remain with the concentrates were retained as such. The strength of KCN used was 1¼ pounds per ton of solution. The ore head used had an assay value of \$41.10.

Screen test of ore before treatment:

All through 60 mesh—	Per cent.
On 80 mesh.	29.2
On 100 mesh.	12.5
On 150 mesh.	7.4
On 200 mesh.	12.2
Through 200 mesh.	37.2
	<hr/>
	98.5

Grams of concentrates recovered, 291.3.
 Percentage of concentrates by weight, 1.604.
 Pounds of concentrates per ton ore, 32.08.
 Assay per ton concentrates, \$1,658.80.
 Value of concentrates in 1 ton ore, \$26.13.
 Percentage extraction by concentration, 63.58.
 Assay original heads, \$41.10.
 Concentrates extraction, \$26.13.
 Calculated assay head after concentration, \$14.97.
 Assay value of sands after concentration, \$15.90.
 Assay value of slimes after concentration, \$12.20.
 Assay value of sands after tube mill and slimes to tank 1 hour, \$2.40.
 Extraction on \$14.97 head in grinding circuit, 83.97 per cent.
 Assay value final residue after 30 hours' agitation, \$1.60.

Total cyanide extraction on \$14.97 head, 89.31 per cent.

Overall extraction by concentration and cyanidation on \$41.10 head (assuming 100 per cent. extraction on concentrates), 96.11 per cent.

The following table shows extraction during tank agitation:

Time.	Assay value.	KCN used.	Extraction on \$14.97 head.	Overall extraction on \$41.10 head.
0	\$2.40	.08	83.97	94.13
3	2.20	.12	85.30	94.64
6	2.20	.16	85.30	*
9	1.70	.48	88.64	*
12	1.70	.48	88.64	*
15	1.60	.48	89.31	*
21	1.75	.48	88.64	*
24	1.50	.48	89.98	96.35
30	1.40	.48	90.65	96.60
Final residue	1.60	.48	89.31	96.11

* Assuming 100 per cent. extraction on concentrates.

Note.—KCN used with concentrates in pulp was about 1.3 pound per ton ore during this treatment.

Treatment of Concentrates.—The 291.3 gms. of concentrate was thoroughly rolled on mixing cloth. A one-fifth portion was taken and ground to pass 200 mesh screen. A duplicate head assay sample was taken and the remainder subjected to cyanide bottle agitation treatment.

The other four-fifths of the concentrate were given a screen test and from each portion a sample was taken and the remainder subjected to cyanide treatment. In addition a "through 200" mesh product of the concentrate from a previous test was given a wash for 8 hours in a 1 per cent. sulphuric acid solution, and then passed to cyanide treatment.

Strength of cyanide solution used in treatment of concentrates, 4.55 pounds per ton solution.

Time of cyanide treatment, 40 hours.

Concentrates 291.3 grams. Test (16-8).

Mesh.	Per cent.	Assay value per ton.	Proportionate value per ton.	Tails assay per ton.	Extraction per cent.	K ₂ O used per ton. Lbs.	CaO used per ton. Lbs.
80	29.89	\$2,048.80	\$612.39	\$18.80	99.08	17.6	16.5
100	12.79	.....	.....	.....	.....	.....	.....
150	12.48	1,737.60	439.09	16.80	99.03	20.4	19.3
200	26.73	887.60	237.25	16.00	98.19	18.3	17.6
Through 200	17.79	2,257.60	401.63	51.20	97.73	31.6	30.6
Through 200	composite	1,658.80	.....	12.80	99.20	18.6	20.5

Concentrates. Test (16-7). Acid treatment before cyanidation.

Through 200	\$1,448.00	\$36.80	97.45	20	15
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Note.—In acid treated concentrates the whole of the KCN and CaO was decomposed, which condition doubtless affected the extraction.

Gold per ton ore in final pulp residue—98.4 per cent. of \$1.60..... \$1.57
 Gold per ton ore in final concentrate residue—1.6 per cent. of \$12.80..... .20

Through 200 mesh. 79.3

 99.5

Assay value \$1.60. Sp. Gr. 2.7.

Calculated overall assay final residue..... \$1.77
 Overall extraction on \$41.10 head..... 95.7 per cent.

Cyanide consumption—
 98.4 per cent. of .48 lbs. KCN = .47 lbs. per ton
 1.6 per cent. of 18.60 lbs. KCN = .28 lbs. per ton

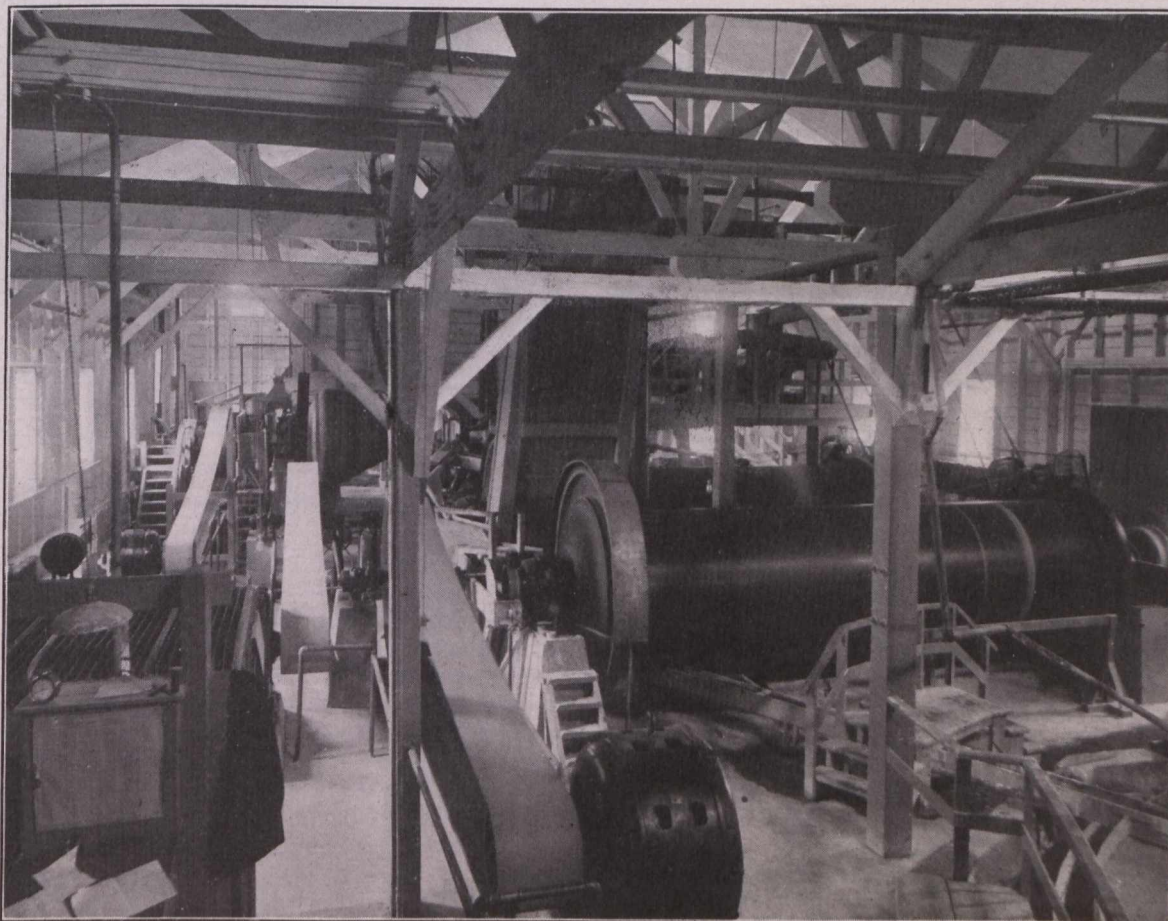
 .75 lbs. per ton

Settling test:

Clear Solution.	Time.
20 per cent.....	8 minutes
50 "	30 "
57 "	40 "
60 "	45 "
68 "	60 "
71 "	82 "
72 "	90 "
73 "	97 "
74 "	110 "

Screen test of final residue:

All through 100 mesh—	Per cent.
On 150 mesh.	7.2
On 200 mesh.	13.0



Tough-Oakes Mill, Kirkland Lake, showing ball and pebble mills

Character of Tough-Oakes Ore.

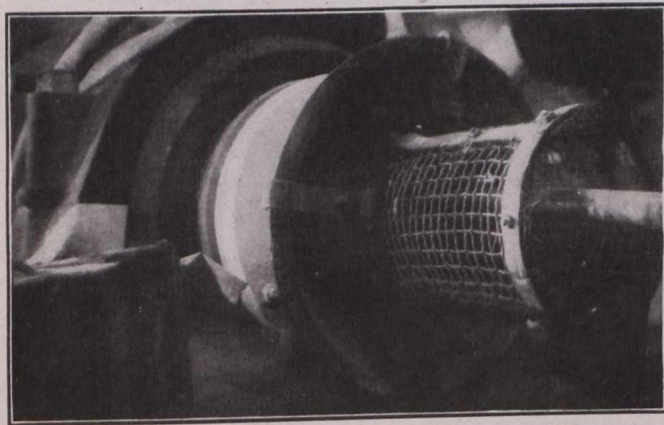
The average run of milling ore consists of about 75 per cent. hard tough porphyry and quartz, and 25 per cent. of softer greywacke and conglomerate. The ore carries about one per cent. of concentrates which with free gold removed has an assay value of about \$250 per ton, and with free gold not removed \$1,000 to \$1,600 per ton. Some of the gold is coarse and approximates about 1.5 per cent. of the total gold recovery, but in general it is fine, occurring in the quartz, associated with sulphides and tellurides, and finely disseminated throughout the wall rock adjoining the vein proper.

The Cyanide Plant.

The construction of the 100-ton cyanide plant was begun in the fall of 1914, and actual milling began March 15th, 1915.

Elevating and Crushing.—The ore is delivered from the main shaft to the mill bin by a skip of 1½ tons capacity. From the mill bin the ore discharges to a 12 by 20-inch Buchanan crusher, with opening set at 2 inches. From this crusher the ore is hoisted by bucket elevator to a 30-inch by 60-inch Gates-type revolving screen having 1½-inch circular openings. The oversize of this screen goes to a 10-inch by 16-inch Buchanan crusher, set at 1¼-inch opening, and then returns to the screen by the same bucket elevator. From the trommel screen the undersize falls to a 14-inch conveyor belt which delivers it to the crushed ore bin of 150 tons capacity.

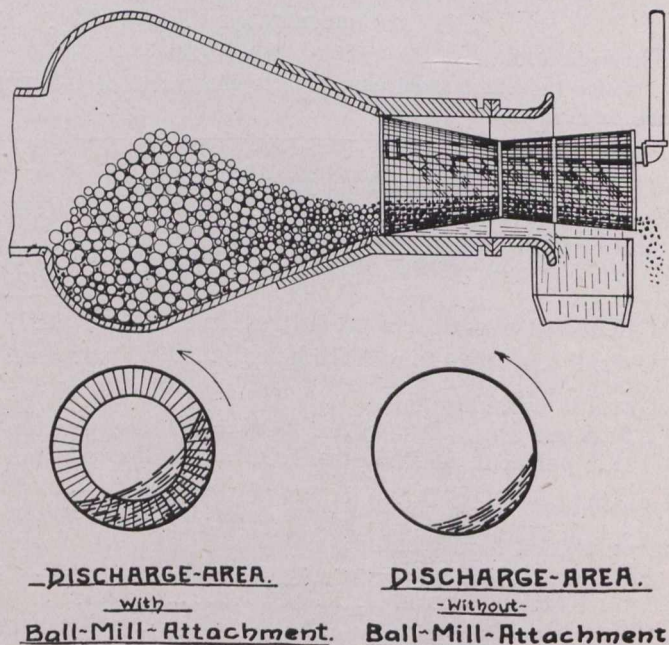
Ball and Tube-Mill Circuit.—The ore is discharged from the crushed ore bin by three eccentric plunger feeders on to a 14-inch conveyor belt leading direct to ball mill feed box. The Hardinge ball mill is 6 feet in diameter and operated at a speed of 29 r.p.m.



View of discharge end of ball mill showing screen attachment

During the months of May, June and July, 1915, under normal power conditions, and with ball load varying from 4 to 4½ tons, the average tonnage treated in the ball mill for total time was 82.68 tons, and for actual running time 90.62 tons per day, with a total power consumption of about 43 h.p. On August 1st a ball mill attachment was installed, with a result that all oversize going to the tube mill circuit was eliminated, the ball load was increased nearly 30 per cent. and the required power necessary to drive the mill reduced to 37 h.p. During the five following months the tonnage delivered to the tubes through a ⅜-inch opening and approximating 75 per cent. through ¼ mesh was for total running time 102.27 tons, and for actual running time 110.41 tons per day.

This shows over an eight months test a tonnage increase of over 25 per cent., and a total decreased power consumption per ton of ore treated of 28.1 per cent. The ball consumption decreased from 2.4 lb. to 1.8 lb. per ton of ore, and the life of ball mill lining has increased from four months to seven months. The ball mill attachments permit of a rapid removal of any oversize particles at or near the discharge opening of the ball mill, thereby permitting it to be discharged, classified and returned to the head end or zone of maxi-



DISCHARGE-AREA.

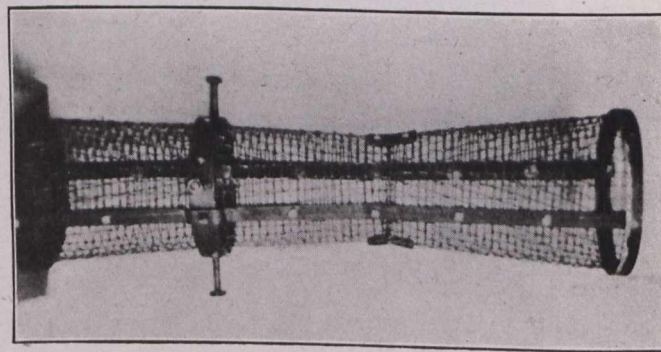
With

Ball-Mill-Attachment.

DISCHARGE-AREA.

Without

Ball-Mill-Attachment.



Screen attachment for ball mill.

mum crushing efficiency, and at the same time by its removal giving a more free and rapid discharge of sufficiently ground pulp with a minimum of slime.

The undersize product from the ball mill discharges on a trough screen of ¼-inch mesh, the oversize from which is forced by a jet of solution down through a centre channel of an amalgamation table, on either side of which are strips of cocoa matting. The fines passing through this trough screen pass over the cocoa matting. By aid of this matting and traps at the foot of the table coarse gold is collected amounting per month to from \$800 to \$1,500, depending for the most part on the value of the ore heads to the mill. The weight of the largest pieces recovered in this manner varies from 1 to 6 dwt.

The discharge from the foot of the table goes direct to the first duplex Dorr classifier, which together with the first tube mill is in series with the second duplex classifier and tube mill. The tubes are 5 feet by 20 feet,

and fitted with the Globe type liners. By removing the perforated disc at the discharge end of the tube mills and replacing them with an attachment similar to that used in the ball mill, but of smaller mesh openings, a more rapid discharge was obtained, as well as an easy method of removing from the grinding circuit an accumulation of undersize pebbles, or oversize ore. Before the attachment was installed in ball and tube mills the average pebble consumption was about 16 pounds per ton of ore treated. The pebble feed at the present time is less than 4 pounds per ton of ore. Chunks of hard porphyry ore are also added, approximating 3 pounds per ton of ore.

Cyaniding.—The cyanide plant consists essentially of one 30-ft. by 10-ft. steel primary Dorr thickener, working in series with three agitators 16-ft. by 12-ft., followed by four 28-ft. by 10-ft. Dorr thickeners. The pulp from the classifiers flows into No. 1 thickener at 85 per cent. moisture. The overflow from this tank is the "pregnant solution" and has an average value of about \$3.50 per ton. The underflow is discharged into the agitation circuit at a moisture content around 44 per cent. The average value of solids to agitator circuit is \$4, which on an original average ore head of \$22 gives an extraction in grinding circuit approximating 82 per cent. The moisture content during agitation is maintained at about $2\frac{1}{2}$ of solution to 1 of ore. In the first agitation the cyanide strength in total cyanide is maintained at 3 pounds per ton of solution. Enough lime emulsion also is added to keep the alkalinity in terms of CaO at 1.5 pounds per ton of solution. The pulp going to the agitators is diluted entirely with crushing solution which has a cyanide content of 2.5 pounds and a CaO content of 1.2 pounds per ton of solution. The solids from the agitators have an average value of about \$2.20 per ton.

From the third agitator the pulp flows into thickener No. 2. The overflow solution of this thickener discharges into a lower crushing solution tank and carries an average gold value of \$1.20 per ton of solution. The underflow pulp is drawn by diaphragm pumps through the remaining thickeners with a moisture content of about 44 per cent. The solids discharged from the last thickener give an average assay of \$1.20 to \$1.40 per ton. The dissolved gold loss varies between 15c and 20c per ton. A fourth agitator is now under construction, by aid of which it is expected there will result an increased extraction and decreased dissolved gold loss.

The barren solution from the precipitation presses is delivered to thickener No. 4, a small portion going to thickener No. 5 if dissolved gold loss is tending to be high; a condition most pronounced when the porphyry content of the ore is above the average.

Precipitation.—Zinc dust is used as a precipitant, and is fed into the suction of an Aldrich triplex pump by a Merrill zinc feeder. The emulsified dust and pregnant solution are raised to two 36-inch Merrill precipitation presses. During the first six months' operation of the mill the presses were run alternately for periods of 15 days. In starting up a press the zinc feed was set at about .2 lbs. per ton of solution, and 10 additional pounds of zinc were fed by hand. The average zinc feed over each 15-day period approximated .195 per ton of solution and gave a resultant precipitate around \$35 per pound. In October precipitation experiments were begun with two objects in view; that of determining the curve of minimum zinc feed, and the elimination of acid treatment of precipitate.

The result of these experiments has led to the following practice:

Both presses are started on the first of the month on a zinc feed of .2 of a pound per ton of solution. To each press, as it is started, 10 additional pounds of zinc is fed by hand. During the first two days the barren assay around 4c, on the third day 2c, and on the 4th day 2c, and under. During the next ten days there is an average decrease of one-half point per day in zinc feed, so that on the 15th of each month the zinc feed is about .150 pound per ton of solution. Should the presses be cleaned up on the 15th this means that the zinc feed must immediately be increased to .2 of a pound, which on a solution feed of 500 tons per day means an immediate increase of 25 pounds of zinc per day. From the 15th of each month to the end of the month the rate of decreasing zinc feed becomes slower, else there results an impoverishment of zinc in the presses, and a resultant increase in assay value of the barren solution. By careful manipulation the zinc feed at the end of each month is generally around .130 pound per ton of solution precipitated. In this manner the average monthly feed has been reduced to .165 pound per ton of solution, amounting to a saving of over 400 pounds of zinc per month.

When using an average zinc feed of .195 pound per ton of solution the average value of precipitate recovered averaged about \$35 per pound. The resultant precipitate with an average monthly zinc feed of .165 pound per ton of solution averages about \$78 per pound, and the quantity recovered is reduced in bulk about 50 per cent.

The precipitate having a moisture content of about 40 per cent. when taken from the presses is removed direct to a steam drying pan in the melting room where its moisture is reduced to about 5 per cent. in 36 hours. No acid treatment is given precipitate owing to much reduced zinc contents. After drying it is mixed with fluxes in the drying pan in the following proportions:

	Pounds.
Precipitate.	100
Borax.	18
Soda.	10
Silica.	5
Nitre.	2

Melting is done in oil burning tilting furnace using a No. 275 long lipped crucible. The time taken for melting a month's run of precipitate approximates 20 hours. One graphite pot lasts two melts. About 25 pounds of matte is recovered, each melt having a value of about \$25 per pound.

The matte is reduced with cyanide and borax in the usual proportions, the slag from which assays about \$2.50 per pound. The bullion recovered is 680 fine in gold and 210 fine in silver, having a total value per ounce of \$14.

TRIUMPH MINES, LTD.

South Porcupine, April 22.—Very satisfactory results are being realized from the development work now in progress on the Porcupine Success property, owned by the Triumph Mines, Ltd. The shaft is down to the 200-foot level and crosscutting is being pushed. This shaft will be continued to the 300-foot level, and it is the intention to go ahead immediately with the sinking of a double compartment shaft on another part of the property, as recommended by Mr. Peter McLaren, who is on the property overseeing operations.—Porcupine Herald.

CANADIAN MINING INSTITUTE, WESTERN BRANCH

The twenty-first general meeting of the Western Branch of the Canadian Mining Institute was held at Ladysmith, Vancouver Island, B.C., on Thursday, March 30th, presided over by Mr. Thos. Graham, of Victoria, chief inspector of mines for British Columbia, who is this year's chairman of the branch.

Afternoon Session.

At the afternoon session a welcome was extended by the Mayor of Ladysmith, who also expressed the hope that it will not be long before the branch will again meet in Ladysmith. The chairman briefly acknowledged the courtesy of the mayor and other prominent citizens, and then gave a general review of the progress and condition of the mining industry of British Columbia.

A paper by Mr. W. J. Dek, of Ottawa, mining engineer to the Canada Commission of Conservation, presented at the annual meeting of the Institute, held in Ottawa early in March, was read by the secretary of the branch, Mr. E. Jacobs, of Victoria, and discussion was invited thereon. Mr. J. H. Cunningham, manager of the Extension colliery of the Canadian Collieries (Dunsmuir), Ltd.; Mr. W. M. Brewer, of Victoria; the chairman, and others discussed the paper. In the course of the discussion mention was made of the efforts of the Ladysmith Board of Trade, and the boards of other cities, to induce the Dominion Parliament to impose a customs duty on fuel oil imported into Canada, and a vote of thanks was passed to all who assisted in promoting that movement, which had been successful. Mr. G. A. Bonnallie, president of the Ladysmith Board of Trade, spoke briefly in acknowledgment.

Expressions of opinion were invited relative to a proposal made last year by Mr. E. A. Collins, of Kingston, Ontario, that "without taking into account the Albert Medal given by His Majesty the King for bravery and leaving aside the medal and other recompense provided for by the Carnegie Hero Fund, the Canadian Mining Institute provide a suitable medal to be granted in recognition of bravery by workmen in our mines and smelters." The secretary read the letters of Mr. Collins and other members of the Institute that had been published in the C. M. I. Monthly Bulletin, among them one in which Mr. Thos. Graham, chief inspector of mines for British Columbia, had stated his view that "the Albert Medal has a value far in excess of any reward that could be offered by the Canadian Mining Institute. The thing most needed to obtain recognition for our heroes of mine and smelter is the help of some recognized institution to assist in arranging the facts, presenting, endorsing and pressing the claim for recognition for the Albert Medal upon the proper authorities, which important part of the work could be taken up by the Canadian Mining Institute." After an interesting discussion, on the motion of Mr. H. N. Freeman, manager for the Vancouver-Nanaimo Coal Mining Co., seconded by Mr. J. H. Cunningham, Mr. Graham's view of the question was endorsed by the meeting. The session was then adjourned to allow those present to visit the Extension colliery, ten or twelve miles away, going by train, to see the mine-rescue training station and the ambulance car of the Canadian Collieries Co., both in immediate proximity to the main entrance to the largest of the Extension mines. On return to Ladysmith, Mr. Cunningham took the visitors to see the coal-washery and coal-bunkering

facilities at the company's coal shipping docks on Oyster bay, within half a mile of the business centre of Ladysmith.

Evening Session.

At the evening session, which was attended by more than 100 residents, chiefly coal miners, Mr. Brewer, continuing the discussion of Mr. Dick's paper on "The Coal Situation," gave some instructive information concerning by-product coke ovens, the installation of which at well-chosen points was advocated by Mr. Dick.

Mr. Cunningham gave interesting particulars of work done in making a 300-foot vertical raise in No. 3 mine, Extension colliery, and in this connection Mr. Graham added information relative to his own experience in doing similar work elsewhere.

Mr. James Strang, Mr. Cunningham's assistant at Extension colliery, read a paper on First-Aid and Mine-Rescue Work in Ladysmith District, and gave particulars of the number who had been instructed in rendering first-aid to the injured and the excellent results that had been achieved. Mr. Dudley Michell, instructor in first-aid for the British Columbia Department of Mines, supplied data concerning the considerable activities at both coal and metal mines in the province in connection with instruction and competitions in both first-aid and mine rescue work. Mr. Graham added particulars of the oxygen-breathing and other mine-rescue apparatus at coal and metal mines. Numerous lantern slides were shown, giving views of competitions, competing teams, rescue stations, ambulance cars, etc., in British Columbia. Mr. Graham made an announcement of especial interest to miners, in effect that mine-rescue training certificates issued in British Columbia would be recognized in the United States by the United States Bureau of Mines under stated proper conditions, and, similarly, those obtained in that country would be recognized in British Columbia.

Some information regarding analyses of mine air, made at Ottawa, and the unusually large quantities of gas given off in certain mines, submitted to the meeting by the chairman, caused much surprise.

A number of lantern-slide views in connection with the hydro-electric power system on Puntledge river, Comox district, Vancouver island, which supplies electric power to several of the mines of the Canadian Collieries Co.'s Comox colliery, were shown, with some explanatory comment. Then followed views of modern bankheads and other surface works at several Vancouver Island coal mines; a few views of Nicola Valley coal mines, and the big near-surface deposit of coal at Corbin, Crow's Nest district.

The session was closed with votes of thanks to those who had contributed papers, to the district press, and to residents for many courtesies shown.

HUDSON BAY ZINC CO.

Nelson, B.C.—In the last issue of the British Columbia Gazette is announced the incorporation of the Hudson Bay Zinc Co., Limited, with a capitalization of \$5,000,000, divided into 1,000,000 shares.

The company is empowered to carry on a mining and smelting business and to purchase from Maurice W. Bacon and William E. Cullen, Jr., fourteen mining claims situated in the Kootenay mining division. The Hudson Bay Co. has its headquarters at Salmo. Maurice W. Bacon and William E. Cullen, Jr., are at present associated with others in the operation of the Hudson Bay mine at Salmo, which it is believed will be the principal property to be controlled by the new company.

PERSONAL AND GENERAL

Mr. Robt. Bryce has returned to Toronto after visiting a property at Porcupine with Mr. G. C. Bateman.

Mr. John Macdonald has been appointed mine captain at the Deloro property now being developed by the Coniagas company.

Mr. Geo. G. Thomas has been appointed manager at the Dome Lake mine, Porcupine.

Mr. W. D. Keeley, mine superintendent at the Dome Lake mine, has resigned.

Col. A. M. Hay was at Timmins last week after visiting the Lucky Cross mine at Swastika.

Mr. H. W. Hardinge was at Porcupine last week. He has returned to New York.

Mr. P. Negrin has returned to New York from Boston Creek.

Mr. M. Summerhayes, manager of the Porcupine Crown mine, has returned to Porcupine.

Mr. D. A. Dunlap is in California.

Mr. M. J. O'Brien has been elected a trustee of Queen's University, Kingston.

Mr. W. H. Robinson, new president of Canadian Consolidated Rubber Co., is vice-president of Granby Mining, Smelting & Power Co. and a director of Crowsnest Pass Coal Co.

Mr. E. C. Kingswell is at Haileybury.

Mr. H. S. Robinson is in charge of operations at the Lucky Cross mine, Swastika, and at the Rochester mine, Cobalt, for the Trethewey Mining Co.

Mr. Clifford Smith is at Timmins, Ont.

Mr. G. C. Bateman has returned to Toronto from Porcupine.

Mr. Charles Spearman has been appointed manager of Adanac Silver Mines, Ltd., operating a property near the Temiskaming mine.

Mr. R. B. Lamb has moved his office to 25 Broad St., New York, from 43 Exchange Place. Mr. Lamb is now consulting engineer for Oatman Southern Mining and Milling Co. and Pittsburgh Mining and Milling Co., also of Oatman.

Mr. P. A. Robbins was in Toronto last week.

Mr. C. A. Foster is in Toronto.

Mr. Harry Oakes was in Toronto last week.

Mr. C. H. Hitchcock, of Copper Cliff, was in Toronto last week.

Mining and Scientific Press, San Francisco, says: "Frank A. Ross, of Spokane, Washington, was honored at the recent inauguration of Dr. Ernest O. Holland as President of the State College of Washington, Pullman, by having conferred on him the degree of Master of Science in Engineering 'in recognition of his service to the mining industry of the Great West.'" Mr. Ross was for some time general manager for the estate of the late Marcus Daly, of the Nickel Plate group of gold mines and the 40-stamp mill and cyanide plant, in Camp Hedley, Similkameen, B.C.

Mr. H. Foster Bain, of London, England, editor of The Mining Magazine, has gone to Johannesburg, South Africa, to study mining conditions on the Rand.

Mr. W. B. Bishop, superintendent of the Granby Consolidated Co.'s copper smeltery at Grand Forks, Boundary district of British Columbia, has been spending two or three weeks in the Coast cities of the province.

Mr. R. Randolph Bruce has returned to East Kootenay, British Columbia, after having been in England for the winter.

Mr. Wm. Thomlinson, of New Denver, B.C., who did such good work in collecting British Columbia minerals for inclusion in the Canadian exhibit at the Panama-

Pacific International Exposition, and afterward in giving to thousands of visitors to the Canadian pavilion much useful information relative to the mineral resources and mining industry of Canada, has been appointed to the Canada Exhibition Commission staff at the Panama-California Exposition at San Diego, California, whence he went about the middle of April. Canada's very fine exhibit at San Francisco has been removed to San Diego, where it will remain until the close of the exposition there next year.

Mr. Anthony J. McMillan, liquidator of the Le Roi Mining Co., is expected to shortly visit Northport, Washington, where is situated the company's smelting works, sold last year to prominent mining men and capitalists of the Coeur d'Alene district of Idaho, U.S.A.

Mr. R. P. Williams, of Vancouver, B.C., well known to mining men in British Columbia as the representative of the Ingersoll-Rand machinery manufacturing company, went to New York City last month.

Mr. J. W. Bryant, for several years mine superintendent for the Tyee Copper Co., operating in British Columbia, and afterward in Asiatic Russia in charge of a mine for a British company, expects to shortly go from England to the Continent on active military service.

IN THE PAS DISTRICT.

The Pas Herald, published at The Pas, Manitoba, published on April 21 the following notes on activities in Manitoba's new mining camp:

Mr. Jack Hayes is opening a stopping place at the mouth of the Goose river, where the Ross boats will land this summer, en route to Flin-Flon, Schist Lake and the sulphide fields.

Jack Callinan is looking after the five claims he sold for Zar Crittenden and E. R. Cullity, at Flin-Flon. Callinan says the deal went through, the papers are signed, and the money paid.

Mr. B. M. Stitt has given a 30-day option on his three claims at Flin-Flon to M. B. Gordon, for \$50,000. The claims adjoin the Crittenden group. Mr. Gordon is a former manager of the Cobalt Lake Mining Company. He also has the option on the Rex claims at Herb Lake.

Mr. Jack Hammell is in Toronto and is expected in The Pas early next month.

The winter rush to Little Herb Lake resulted in strong reports of the gold showings there, but it now develops that the showings are confined in less than an inch stringers, though free gold runs through plentifully. Prospecting done there has been practically of no account. The overburden is heavy and the underbrush quite thick, which has militated against intelligent work, and the few men who have been in there have done very little to determine the status of the mineral deposit.

The diamond drill operations at Flin-Flon appear to be satisfactory. The drillers and engineers are loath to say what the results amount to, and any reliable information is difficult to secure. The Herald depends upon its source of information from trappers, dog mushers and teamsters, who worm it out of the drillers and engineers in an innocent, unsophisticated manner, and everybody is made happy about it.

Mr. M. H. Newman, geologist of the Great West sulphide mines at Flin-Flon, got in from Mascot, Tennessee, yesterday, en route to the mines.

Mr. C. B. Flynn, the well known Ontario mining capitalist, is expected here with Jack Hammell next month, to inspect Flin-Flon.

SPECIAL CORRESPONDENCE

PORCUPINE, KIRKLAND LAKE, SWASTIKA

Porcupine Vipond.—The development of most interest in the camp during the past two weeks has been the striking of the Davidson vein on the Porcupine Vipond. Owing to the active market in the stock, details on the Vipond are usually watched with a very great deal of interest. The last report issued covering the last three months of the year 1915, revealed such a discouraging production that the better development of the 400-foot level was the more welcome. There has now been opened up from the winze at the 400-foot level an ore shoot 135 feet long averaging between 5 and 6 feet wide and about \$15 ore. This is, of course, about double the value of mill run during the latter part of the year 1915. From the winze little or no ore was encountered for 180 feet. A crosscut was then started and only a few feet to the north the vein was picked up. It was driven on towards the shaft. About 30 feet from the shaft the vein again broke up into small stringers and it was decided to crosscut directly in the shaft with the purpose of raising and making connections with the 300-foot level. The exploratory crosscut was commenced about 180 feet from the winze, but the vein was not picked up until it was about 12 feet further to the north than on the 400-foot level. It was then encountered. The vein is about 10 feet wide, of \$10 ore and it shows every evidence of developing into a fine ore-shoot. This discovery consolidates the ore reserves of the Vipond and makes the prospects of the company very much better. But those who would look for an immediate increase in the production will probably be disappointed. The mill will run on the lower grade of ore on the upper levels until direct connection has been made with the winze and the 400-foot level, and the cage is running down to the 400-foot level. This aim may not be attained until the beginning of June.

The Hollinger Merger.—There is no official pronouncement yet as to the probability of the merger of the three properties contained within the control of the Canadian Mining & Finance Co. It is generally believed that there is much more probability of it than at any previous time. Four years ago the amalgamation of the Hollinger Gold Mines, Acme Gold Mines and Millerton Gold Mines was mooted and was very nearly put through. It was then contended, however, that the Acme was an undeveloped prospect and could not be valued with any definiteness. To-day it is a mine and second only to the Hollinger in the Pearl Lake area and consequently the valuation of it can be much better established. The desirability of the merger from the operating standpoint is so obvious as to need no further explanation. The central shaft will be the basis of all operations and if the identity of the three companies within the Canadian Mining and Finance is maintained, it will avoid much needless duplication of staff and bookkeeping.

Dome Mines.—The delivery of mining machinery is to-day the greatest barrier to the quick construction of plant in the Porcupine camp. This applies very particularly to the Dome, where so much machinery is at present on order. It is probable that hoisting from the big central shaft may be delayed by the non-arrival of the two big winding engines, delivery of which cannot be ascertained definitely. In the meantime the 125-foot steel head frame will be set up at once. The shaft itself is now completed to the 700-foot level and until such time as it is possible for hoisting to be undertaken

from the new shaft it is not probable that it will be sunk further. It is from this shaft that the development of the Dome Extension will be undertaken by the Dome.

McIntyre-Jupiter.—The slow delivery of machinery has also been responsible largely for the delay in making the Jupiter productive. It was hoped that the two vertical compressors from Scotland would be installed for the Jupiter, so that hoisting could be commenced with the enlarged plant, but there have been so many delays in shipping that the old compressor will be used for starting operations. It is reassuring to know, however, that the two compressors have arrived in Canada and should soon be at the mine. The rock-house and head frame at the Jupiter have almost been completed and the surface tramway from the No. 5 shaft to the Jupiter is well under way. The ore will be taken from the Jupiter shaft over the surface to the No. 5 shaft and there sent over the aerial tramway to the McIntyre mill. This is only a temporary arrangement until the long crosscut between the old shaft of the Jupiter and McIntyre Extension shaft is completed. This will be a long undertaking, however, and in the meantime the ore will be trammed over the surface. The various units of the McIntyre mill are not yet running and capacity of the maximum of 450 tons a day may not be attained until Jupiter ore is available. The last quarterly report of the McIntyre was a great improvement on the previous one. Tonnage was 27,248; an increase of over a thousand tons. The value of ore treated was 35 cents a ton higher, while the operating costs were 31 cents a ton less giving an increased operating profit of \$21,643 for the quarter, or \$91,128. Operating costs were \$3.85 and gross value \$210,840, from which a recovery of 95.4 per cent. was made. At No. 5 shaft on the 700-foot level the crosscut to the north intersected a large ore-body which had been previously cut by diamond drilling. The width of the vein was 17 feet of high grade milling ore. In continuing this crosscut to the north a parallel vein was intersected at a distance of 12 feet beyond the first vein, showing high grade milling ore 4½ feet in width. The crosscut from the McIntyre Extension shaft to the No. 5 shaft at the 1,000-foot level is well advanced, and from 10 to 15 feet a day is being made.

La Rose and Coniagas in Deloro.—Owing to the advent of two companies with adequate reserves it is most probable that Deloro will be the centre of very active mining operations all this year. The La Rose is working the Maidens-MacDonald quite actively and it is announced that at least one of the diamond drill holes has been quite satisfactory. A shaft is also being sunk. The Coniagas Mines has now one diamond drill running and it will be put down to 800 feet and an adit will also be started on the same vein.

Standard.—The Porcupine Premier is running drills on the old Standard and the Chisholm Corporation has five diamond drills operating on the Chisholm veteran.

West Dome.—Mr. Trethewey has taken up his residence at the West Dome Consolidated and a diamond drill is already running. It will be put down to 800 feet so as to cut the vein if sunk on at the shaft. The shaft will be put down on its present incline of 65 degrees to the 300-foot level, but not until then will exploration be commenced. Exploration at this property was previously of a very haphazard nature and few records were left to guide the new management. There are no less than seven shallow shafts on the property.

Dome Lake.—Owing to an imminent change in the control of the Hudson Bay Mines, Mr. A. H. Brown has resigned his position at the Dome Lake. He has been in charge here since the Hudson Bay bought control of this property. Mr. Keely, mine superintendent, has also given in his resignation which will take effect on the first of the month. The agitation drum which is to treat the tails from the plates is now installed and should be running very shortly. There is much speculation as to whether the process can be made a success. It is quite new in camp and the innovation is being watched with much interest.

Copper.—Owing to the very keen demand for copper, various syndicates are busy looking up what deposits there are in the north country. The Rand Syndicate has already shipped two cars of copper from Temagami; one from Cedar Lake, and one from a point two or three miles west of the settlement. On the T. C. R. Mr. Campbell and a Montreal syndicate are taking copper out of a deposit near Spirit Lake about 190 miles east of Cochrane. The same company is also mining molybdenite south of the track at Keewagama. A New York and English syndicate represented here by Mr. W. E. Simpson is also preparing to develop molybdenite prospects at the same point. Mr. Simpson has had great success with oil flotation as a method of concentration with this ore and his company will go forward with the project very shortly.

Lake Shore.—At Kirkland Lake the most interesting note of the last two or three weeks is the striking of what may be a new orebody on the Lake Shore. In a crosscut on the 300-foot level to the north of the main drift a vein has been picked up about seven feet wide. There is about six inches of remarkable high grade ore and the milling average will be quite high.

The question of power is the most debatable matter in the camp at present. For various reasons the Northern Ontario Light and Power has hesitated to extend its transmission lines to Kirkland Lake. The tremendous price of copper is one of the factors in the situation. It is believed, however, that the company will put through lines this year.

Teck-Hughes.—The Teck-Hughes mill is finished and mining commenced again on April 17th. The sampling of the first level of the Lucky Cross has been completed and drills are now running, it is stated, and results to date are quite reassuring.

COBALT, GOWGANDA AND SOUTH LORRAIN

The high price of silver is having a tendency to open up old prospects. This seems to apply to out-lying sections more than to Cobalt proper.

In Gowganda, it is reported that the Bishop Silver Mines have struck some high grade 800-foot back in the tunnel they are running. This is one of the properties operating near Calcite lake, in the Wigwam district at Gowganda; the other is the Barbara Mining Co. In Gowganda itself the leasing company operating the Reeves Dobie, is assembling a rich car of ore.

At Elk Lake there has been much activity in Auld township where the Kenabeek mines and several other prospects are developing. There are here some very rich, but very narrow, silver veins in the diabase.

In South Lorrain, the success of the Comfort Mining & Leasing Co. in opening up the Wettlaufer will stimulate interest. The leasing company has already sacked several bags of high grade ore and is putting the old

mill in shape to treat the lower grade. It is expected that a shipment will be made soon after transportation opens on the lake. The Belle Ellen is also working with encouraging results.

The winze being sunk below the 200-foot level on the McKinley-Darragh is producing quite interesting results. This winze is being put down in the footwall of the Cobalt Lake fault. It is now down 150 feet and is still in good conglomerate. While there is nothing definitely established this fact gives promise of a much deeper area than could have been anticipated a year ago.

BRITISH COLUMBIA

An amendment to the law relating to disposal of Crown-granted mineral claims that have been forfeited to the Crown for non-payment of taxes on such property, is proposed by the Government of British Columbia. This provides that such claims may be leased from year to year, that the lessee may go on and work them, and at any time during the pendency of his lease may himself obtain a Crown-grant on paying all taxes, costs and charges on the claim, provided he shall have expended in doing development work on the property not less than \$200 annually during his lease, in which event no taxes shall be levied on the claim for the term of the lease.

Cariboo.

This district did not share in the unusually heavy snowfall which in February was experienced in the lower Coast district, and some other parts of British Columbia, consequently the outlook for there being an abundant supply of water for hydraulicking purposes at the Cariboo placer-gold mines was not so good as had been hoped it would be. However, it appears that conditions in this respect are improving, for a weather report published in Victoria on April 13th included the following information: "The region of the Cariboo was the coldest area on the weather map and the scene of continual snowfall. For the week ended April 11th, sixteen inches of snow has fallen at Barkerville. It was still snowing there when this report was made to the local meteorological station last night."

Kamloops District.

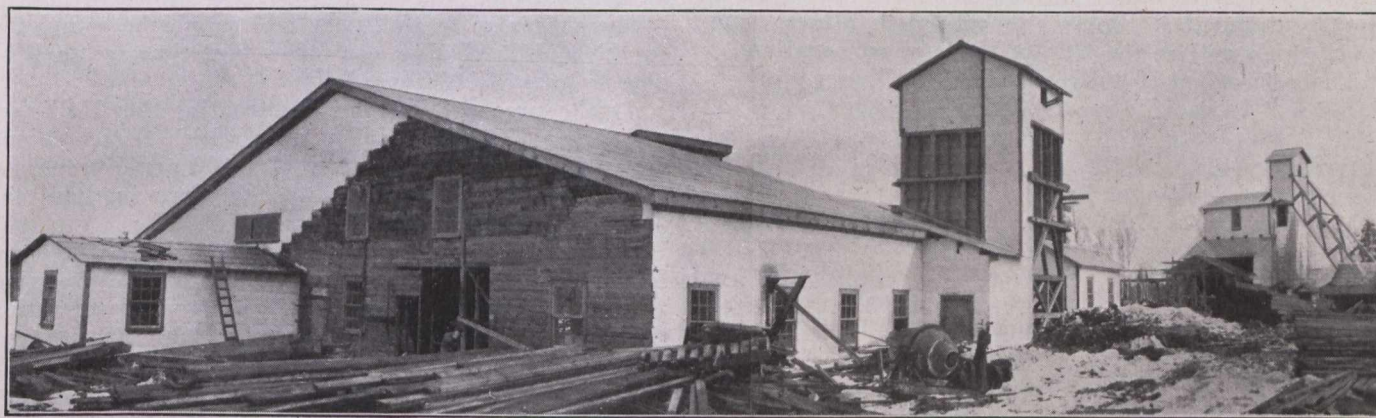
The **Iron Mask** mine, situated about six miles southwest of the town of Kamloops, for several years has been the only metalliferous mine in Kamloops district to ship ore to a smeltery. Its output of ore and concentrate during 1915, shipped to Trail, was approximately 2,000 tons; during the first quarter of 1916 receipts at Trail from this mine totalled 738 tons. Quite lately, the **Foghorn**, in the northern part of Kamloops mining division sent out some ore, while several carloads have been shipped to Boundary district smelting works from the **Aberdeen**, in Nicola mining division, formerly part of Kamloops district.

Foghorn.—It is of interest to note that the shipment of 52 tons of ore from the Foghorn which reached Trail early in April was the first received from that property and probably the first ore ever shipped in bulk from it. Mr. W. M. Brewer, who in 1913 investigated mining conditions in Kamloops mining division for the Provincial Department of Mines, in his report gave a little information concerning this property, as follows: "The Foghorn group of mineral claims is situated on Whistler mountain, about 20 miles northeast of Chu Chua, at an elevation of about 4,000 feet above the North Thompson valley.

able 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."

SUDBURY'S PRODUCTION.

The Sudbury nickel-copper district has produced nickel-copper matte containing 237,202 tons of nickel and 146,661 tons of copper, besides considerable though comparatively small amounts of platinum, palladium, gold and silver. The value of the nickel-copper matte produced is about \$150,000,000.



The recently constructed Teck-Hughes mill, Kirkland Lake.

The main shaft is now down 200 feet and we are cutting the station at the 175-foot level. We have been sinking on a vein of high-grade ore most of the way down and there is every reason to believe that only lateral development is necessary to put ore in sight. We have two other veins on the property, but no work has been done on them.

TONOPAH DRILLING AT SCHIST LAKE.

The Pas, April 22.—The diamond drill on the Tonopah properties at Schist Lake, near Flin-Flon, was spaded early in the week, and drilling commenced, is the report from the north. The scene of the first drilling is near the lake shore on the Mandy claim. The vein width on this property is said to be fifty feet wide, all in ore, with ten feet of rich copper. It is understood the drilling is for depth values to begin with.

AT FLIN-FLON LAKE.

Reports from the diamond drilling at Flin-Flon say the drills are working at their third set of holes. No detailed information was given out. The results continue to please the engineers and drillers, it is said, and they are waiting for some returns of the assayers on the values in the diamond drill cores sent them. From a reliable quarter it is learned that the average value of the sulphide hovers between \$10 and \$12 a ton.—The Pas Herald.

COBALT SHIPMENTS.

Cobalt, April 22.—Ore shipments for the week ending last night showed a considerable increase over the period immediately preceding. Five companies shipped a total of 669,717 lbs., compared with 471,877 lbs. the week preceding. The Dominion Reduction led with three cars totalling 238,000 lbs. Of the nine cars shipped, only one went to a Canadian smelter; one car from Seneca-Superior going to Thorold, Ont. The bullion shipments were lower than last week. A total of 91,423.88 oz. was shipped, compared with 375,295.24 oz. the previous week.

Ore shipments for the week were as follows:

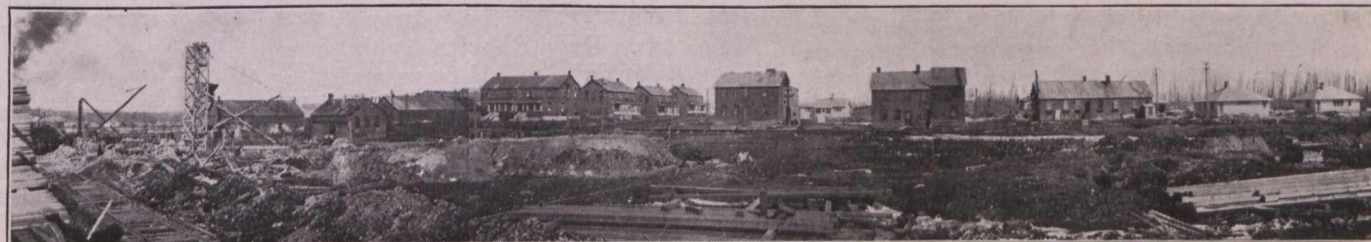
Company.	Lbs.
McKinley-Darragh	171,920
Dominion Reduction	239,000
Peterson Lake (Seneca ore)	93,892
LaRose mines	87,830
Beaver mine	77,075

Bullion shipments for the week were:

Mining Corporation	32	41,323	\$26,980
Nipissing	43	50,099	33,340

Bullion shipments for the year to date are as follows:

Company.	Oz.	Value.
Nipissing	1,941,623	\$1,394,695
Mining Corporation	176,043	111,262
Dominion Reduction	132,860	78,137
Crown Reserve	95,495	57,300
O'Brien mine	91,549	56,604
Miscellaneous	14,703	8,388



Looking north from Dome mine, showing location, left of photo, of hoist house for new shaft.

HOLLINGER MERGER ANNOUNCED

Just as we go to press on April 29, we have received word that the expected merger of Hollinger, Acme and Millerton properties has finally been decided upon. Claim 13,147 is included.

The properties are to be amalgamated with a nominal capital of \$25,000,000, of which \$24,000,000, in \$5 shares, will be issued. \$1,000,000 in shares remaining in the Treasury of Hollinger Consolidated Mines, Limited, which will be the title of the new corporation.

The allocation of the capital of Hollinger Consolidated will be as follows:

	Shares.	Par Value.
In treasury	200,000	\$1,000,000
Issued to Hollinger shareholders	2,400,000	12,000,000
Issued to Acme shareholders..	2,100,000	10,500,000
Issued to Millerton shareholders ..	200,000	1,000,000
Issued to Canadian Mining & Finance Co., Limited	100,000	500,000
	<hr/>	<hr/>
	5,000,000	\$25,000,000

The most interesting feature of the exhaustive and detailed report submitted by General Manager Robbins deals with the allowances for ore at depths below those already reached by development upon the two principal mines. On the basis of a depth of 800 feet it is estimated that the Hollinger and Acme will have 5,594,370 tons of ore of a gross value of \$48,196,390. On the assumption that the veins persist to a depth of 1,400 feet it is estimated that the two principal properties concerned will account for 10,430,000 tons, with a value of \$81,492,000.

According to the arrangement, Hollinger holders will receive four shares of stock in the consolidated company in exchange for each share of their present holdings, the same rate of dividend as they are now getting, and besides having "increased flexibility in a stock having a smaller market value" they have the assurance of General Manager Robbins of the Hollinger to this effect:

"It is my opinion that Hollinger Gold Mines, Limited, with its assets in cash, bullion, plant, development and indicated ore, is approximately of the same value as the total collective value of Acme Gold Mines, Limited, Millerton Gold Mines, Limited, and Claim 13,147, with their respective plants, developments and indicated ore, and, in addition thereto, the specified plant of the Canadian Mining & Finance Co., Limited, and as a result of this opinion, I recommend that the interests of Hollinger Gold Mines, Limited, and Canadian Mining & Finance Co., Limited, as described herein, be consolidated upon the basis of an equal valuation being ascribed to each of the two interests, the valuation being taken as at January 1, 1916. By so consolidating their holdings the parties thereto will receive the following benefits:—(1) Freedom from loss in case of any geological disturbances found to affect the orebodies. (2) A speculative chance spread over a large area. (3) Lowered working costs.

These conclusions are premised upon analysis of the mining position at the respective properties, their liquid assets and plants and speculative factors, briefly summarized in this way: First—Estimated future profits based upon known ore reserves. Second—

Speculative chances for development beyond present ore reserves. Third—Expenditures already made in plant and development, and live assets, such as cash, investments, etc.

Having established the facts warranting the consolidation, Hollinger ore reserves counterbalancing those of the other properties, the General Manager reinforces his contentions with this optimistic forecast of the future:

The extension to Hollinger mill should be completed by the middle of May, and after that time we shall be able to treat 1,900 tons daily.

At the present time we are treating for Hollinger and Acme 1,500 tons daily, from which the combined net profits are approximately \$220,000 per four weeks. The increased tonnage should therefore increase the profits to \$280,000 per four weeks.

Present Hollinger dividends demand \$120,000 per four weeks, and to maintain this same disbursement to present Hollinger shareholders after consolidating the companies will demand a total of \$240,000 per four weeks.

During the year the central shaft plant must be completed and the Hollinger mill extended to a capacity of 3,500 tons daily. This work will require about one year for its completion and will entail the expenditure of \$750,000 on capital account.

The cash at present in Hollinger treasury will provide \$300,000 of this amount, leaving \$450,000 to be furnished from operations, this being at the average rate of \$34,600 per four weeks. Therefore, our probable income and expenditures per four weeks should be:—

Profits from operations	\$290,000
Disbursements	240,000
Required for plant	34,000
Available for development, taxes and sundries	15,400
	<hr/>
	\$290,000

With the completion of a mill of 3,000 tons daily capacity, we shall probably be able to increase our rate of dividend, and at the same time reduce the value of the ore being treated.

For five years the problem of bringing these properties together has always been in mind. The results of geological research, the solving of milling details, the centralizing of plant of a permanent nature, and the gradual development of underground workings have all been shaped with the idea of ultimately consolidating the properties; and to-day that consolidation is possible. We have reached a point where comparative valuations of the properties may be made, and where the interests of all may be greatly benefited by an amalgamation.

To this may be added the surplus and investments in plants, making in all a gross value of about \$36,000,000 for the purposes of the merger. However, as Mr. Robbins points out, this estimate, as applied to the reserves and immediate mining outlook, is "figured within narrow limits and makes no allowance for the probabilities of ore persisting more than fifty feet beyond the underground working faces." Anyhow, taking the foregoing estimate and assuming "working costs will probably be close to \$3.15 per ton and metallurgical losses not greater than 45c per ton, which makes an allowance of \$3.60 per ton to cover the costs of mining and mill-

ing," upon this basis Hollinger is expected to "show a profit of \$6.05 per ton, while Acme will show a profit of \$5.38 per ton." In that event the gross profits on the tonnage and values as given would be: "Hollinger, \$11,168,300; Acme, \$10,094,816.80, or \$21,263,116.80, as against the issued capital of Hollinger Consolidated, the surplus and the plants, exclusive of the Millerton and Claim 13,147, as they stand. But as \$1,250,000 profit is to be credited to the Millerton and a nominal \$200,000 to Claim 13,147, the mining position at the moment may be taken to represent an assured profit of about \$23,500,000, as against the issued capital of \$24,000,000, leaving all other potential considerations throughout the properties to be fully demonstrated. What those considerations are likely to be is discussed by Mr. Robbins. "Assuming that each vein," of which he has positive information, or a certain amount of proof, "will persist throughout its length to the depth of the deepest working on that vein," he offers this as an estimate:

	Tons.	Value per ton.	Gross value.
Hollinger	2,076,300	\$9.44	\$19,593,600
Acme	2,315,990	8.85	20,507,750
	4,392,290		\$40,101,350
Indicated profit on the above:			
Hollinger			\$12,125,592
Acme			12,158,947
			\$24,284,539

This "allows for no ore at depths below those already reached by development upon the various veins. A limited amount of development work upon the Hollinger and the Acme at the 800-foot level has proved that several of the veins persist to that depth, and, although it may be that some veins do not do so, yet it is quite possible that as work at this level advances it will be found that all of the veins do so persist. At any rate, each property has an equal chance in this respect." Again, taking it for granted, as an hypothesis, "that each orebody now being developed will persist to a depth of 800 feet, and if we apply to each orebody the values and widths shown upon the lowest present working upon that vein," Mr. Robbins ventures this further estimate:

	Tons.	Value per ton.	Gross value.
Hollinger	2,571,900	\$8.93	\$22,983,000
Acme	3,022,670	8.34	25,213,390
Totals	5,594,570	\$17.27	\$48,196,390

There is \$14 ore on the 1,250-foot level of the Hollinger No. 1 vein just now. Late advices state that there is 23 feet of ore worth over \$50 per ton in one of the Acme orebodies at the 800-foot level. Therefore continuity of the veins and values are being proved and warrant optimism. Mr. Robbins emphasizes that the five and a half million ton estimate in certain eventualities allows for "no ore below depths already reached." He restrains himself while tantalizingly dangling dainty morsels like the following:

In the fourth annual report of Hollinger Gold Mines the results of diamond drilling to a vertical depth of 1,485 feet were given. It was shown that at least some veins with their gold contents persisted to a depth of 1,450 feet. In a wince upon the Hollinger we have recently located \$14 ore at a depth of 1,250 feet. If as a

means of further investigating the comparative possibilities of Hollinger and Acme we assume that all the orebodies being developed will persist to a depth of 1,400 feet, and if we ascribe to them conservative values proportionate to the values of the different veins at their upper levels, then this may ensue:

	Tons.	Value per ton.	Gross value.
Hollinger	4,133,200	\$7.68	\$31,737,700
Acme	4,655,070	7.24	34,322,390
Totals	8,788,270	\$14.92	\$66,060,090
Indicated profit on this may be:			
Hollinger			\$16,863,456
Acme			16,944,454
Total			\$33,807,910

Again Mr. Robbins writes with reserve on those figures—one of a "series of assumptions"—but he also directs attention to the fact that even these globular amounts are irrespective "of the persistence of the miscellaneous surface outcrops to a depth greater than 100 feet below the surface. If we assume," he adds, "that those outcrops or their equivalents do persist to a depth of 1,400 feet, and if we ascribe to each vein 80 per cent. of the tonnage so indicated and an average value equal to 60 per cent. of the values obtained at the surface, we have the following as a possible grand total:

	Tons.	Value per ton.	Gross value.
Hollinger	4,520,800	\$7.82	\$35,385,700
Acme	5,909,230	7.80	46,106,890
Totals	10,430,030	\$15.62	\$81,492,590

"Manifestly these two properties, exclusive of the Millerton and Claim 13,147, have attractive certainties and seductive possibilities. For 2,945 feet of Acme outcrops only a nominal credit of 133,840 tons containing \$1,592,500 is taken into account. Hollinger has a similar outcropping situation. Both afford a unique basis for the merger, and promise infinitely more than can be assumed."

TRETHEWEY AND HUDSON BAY.

Operations at the Trethewey and Hudson Bay silver mines at Cobalt, which have been closed down for some time, are to be resumed shortly.

CHAMBERS-FERLAND.

Cobalt, April 28.—Development of the new vein at the Chambers-Ferland is most promising. At the middle of the week it has been driven on for nineteen feet. For that distance the vein averaged from three to five inches of high grade ore with fair values in the wall rock.—Northern Miner.

THE CROESUS.

The results obtained at the Croesus mine are briefly stated by Mr. T. F. Sutherland in a recent article. He says: "In Munro township a group of claims which had been located, but idle for three years, was optioned by a Cobalt company. A prospect shaft 6 x 11 ft. was sunk on the vein, and from this shaft, above the 100-ft. level, \$120,000 in gold was taken out in sinking operations, and in six months about \$1,000,000 worth of ore was blocked out with a small prospecting outfit."

MARKETS

NEW YORK MARKETS.

April 20, 1916—Connellsville Coke—
 Furnace, spot, \$2.25 to \$2.50.
 Contract, \$2.50 to \$3.00.
 Foundry, prompt, \$3.75.
 Contract, \$3.50 to \$4.00.

April 20, 1916—Straits Tin, nominal, 50.00 cents.

Copper—
 Prime Lake, nominal, 29.50 to 30.00 cents.
 Electrolytic, nominal, 30.00 to 31.00 cents.
 Casting, nominal, 27.50 to 28.00 cents.

Lead, Trust price, 7.50 cents.
 Lead, outside, nominal, 7.50 to 7.62½ cents.
 Spelter, prompt western shipment, nominal, 18.67½ to 19.17½ cents.

Antimony—
 English brands, nominal.
 Chinese and Japanese, 39.50 to 40.50 cents.
 American, 39.50 to 40.50 cents.

Aluminum—nominal.
 No. 1 Virgin, 98-99 per cent., 59.00 to 61.00 cents.
 Pure 98-99 per cent. remelt, 57.00 to 59.00 cents.
 No. 12 alloy remelt, 48.00 to 50.00 cents.

Nickel, 45.00 to 50.00 cents.
 Cadmium, nominal, \$1.25 to \$1.50.
 Quicksilver, nominal, \$125.00.
 Platinum—Nominal, \$88.00.
 Cobalt (metallic), \$1.25.
 Silver (official), 65½ cents.

Metal Products.—All prices are nominal as follows:—
 Sheet copper, base, 35.50 cents.
 Copper wire, base 32.50 to 33.50 cents.
 High sheet brass, base, 38.00 cents.
 Seamless brass tubing, 43.50 to 44.50 cents.
 Seamless copper tubing, 43.50 cents.
 Brazed brass tubing, 42.50 to 43.50 cents.
 Brass wire, 38.00 cents.
 Brass rods, 38.00 cents.
 Sheet zinc, f.o.b. smelter, 25.00 cents.

TORONTO MARKETS.

April 26—(Quotations from Canada Metal Co., Toronto)—
 Spelter, 22 cents per lb.
 Lead, 9½ cents per lb.
 Tin, 54 cents per lb.
 Antimony, 45 cents per lb.
 Copper casting, 30 cents per lb.
 Electrolytic, 31½ cents per lb.
 Ingot brass, yellow, 16 cents; red, 21 cents per lb.

April 26—(Quotations from Elias Rogers Co., Toronto)—
 Coal, anthracite, \$8 per ton.
 Coal, bituminous, \$5.75 per ton.

NEW YORK STOCKS.

	April 25th, 1916.		
	High.	Low.	Close.
Beth. Steel	439	429¾	439
Chino	53¾	53	53
Crucible	83¾	78¾	81¾
Dome	25	24¾	24¾
General Electric	162½	161½	162
Goodrich	76¾	76½	75¾
Gt. Nor. Ore	40	39¾	40
Int. Nickel	48¼	47¾	47¾
Kennecott	55¾	54¾	55½
U. S. Steel	84	83¾	83¾
do., preferred	116½	116¼	116½
do., bonds	104¾	104¾	104¾

STANDARD MINING EXCHANGE.

Toronto, April 25th, 1916.

	Cobalt Stocks.	
	Ask.	Bid.
Bailey .....	.08	.07¾
Beaver .....	.41	.40¼
Buffalo	1.20	1.05
Chambers-Ferland .....	.26¾	.26½
Coniagas	4.70	4.45
Crown Reserve .....	.56	.53
Foster .....	.10	.09
Gifford .....	.07½	.07
Gould .....	.00½	.00¼
Great North .....	.05¾	.03½
Hargraves .....	.05	.04¾
Hudson Bay .....	...	26.00
Kerr Lake	4.62½	4.37½
La Rose .....	.63	.60
McKinley-Darragh S. ....	.59½	.57½
Nipissing	7.37½	7.00
Peterson Lake .....	.27½	.27
Right of Way .....	.05	.04½
Rochester .....	...	.03
Shamrock .....	.18	.15
Silver Leaf .....	.02½	.02
Seneca .....	.48½	.47
Timiskaming .....	.66½	.66
Trethewey .....	.19	.18
Wettlaufer .....	.09	.08
York, Ont. ....	.02	.01

	Porcupine Stocks.	
	Ask.	Bid.
Apex .....	.06¾	.05¾
Dome Extension .....	.37	.36¾
Dome Lake .....	.25	.24
Dome Mines	25.37½	25.10
Dome Consolidated .....	.15	.12
Foley .....	.60	.50
Gold Reef .....	.02½	.01¼
Holly	29.75	29.00
Homestake .....	.50	.47
Imperial Reserve .....	.08¼	.07¾
Jupiter .....	.21½	.20¾
McIntyre .....	.93½	.92
McIntyre Extension .....	.25	...
Moneta .....	.12½	.10½
Pearl Lake .....	.00¾	...
Porcupine Crown .....	.70	.68
Porcupine Imperial .....	.03½	.03¾
Porcupine Tisdale .....	.01¾	.01½
Porcupine Vipond .....	.55	.54
Preston .....	.04¼	.04
Schumacher .....	.50	.40
Teck-Hughes .....	.18½	...
West Dome .....	.16½	.15
West Dome C. ....	.24	.23

SILVER PRICES.

	New York, London,	
	cents.	pence.
April 8	61¾	29 7/8
" 10	62¼	29 1/8
" 11	62½	29 1/8
" 12	62¾	29 7/8
" 13	63	30
" 14	63¼	30 1/8
" 15	63¾	30 3/8
" 17	64	30 1/8
" 18	63¾	30 7/8
" 19	64½	30¾
" 20	65¾	31 3/8

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No. 1



The Canadian Mining Journal

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	MacKinnon, Holmes & Co., Ltd.. 10	
	Murphy, Chas J. 15	
	Mussens, Ltd..... 10	

Pre-Cambrian Products

Nickel
Silver
Gold
Iron
Copper
Cobalt
Pyrites
Arsenic
Quartz
Graphite
Talc
Feldspar
Mica
Corundum
Molybdenite
Trap
Marble
Fluorite



Paleozoic Products

Cement
Natural Gas
Brick
Limestone
Sandstone
Salt
Sewer-pipe
Petroleum
Tile
Lime
Gypsum
Calcium Carbide
Pottery



The products of the Paleozoic rocks come from southern Ontario, but some of these are known to occur in similar formations south of Hudson Bay. The Metals occur pre-eminently in the Pre-Cambrian rocks of which only a small proportion have been prospected.

The rapid growth of Ontario's mineral industry during two decades under pre-war conditions is shown as follows:

1893, value \$6,120,593

1903, value \$12,870,593

1913, value \$53,232,311

SUDBURY, possessing the greatest nickel deposits in the world, has produced, since mining operations began about 1885, nickel-copper matte containing 237,202 tons of nickel and 146,661 tons of copper, besides considerable platinum, palladium, gold and silver. Placing the price of nickel at 25 cents and copper at 10 cents per pound, the tonnage produced would have a value of \$147,933,200.

COBALT with its phenomenally rich silver mines which were discovered in 1903, has produced to the end of 1915 ore containing, 234,314,368 ounces of silver worth \$122,754,523.

GOLD

Ontario, which, for the years 1914 and 1915, has assumed the leading position in gold output among the provinces of Canada, produced \$8,501,391 in 1915 from lode mines.

PORCUPINE, the chief gold camp, since its discovery in 1909 to end of 1915, has produced 956,904 ounces of gold, worth \$19,767,902.

KIRKLAND LAKE has advanced greatly since 1912. Gold associated with several tellurides occurs in narrow rich quartz veins.

LONG LAKE gold deposits near Sudbury occur in Quartzite, associated with arsenopyrite. There was a considerable production in 1915.

In **MUNRO TOWNSHIP** a phenomenally rich find was made at the Croesus property in 1915. From 890 pounds of ore \$40,000 in gold was recovered.

At **Boston Creek, Kowkash and Dryden** promising gold finds were made during the year 1915.

Ontario's Mining Lands

Ontario, with its 407,262 square miles of area, contains many millions of acres in which the geological formations are favourable for the occurrence of minerals, 70 per cent. of the rocks being of pre-Cambrian age.

The phenomenally rich silver mines of Cobalt occur in these rocks ; so also do the far-famed nickel-copper deposits of Sudbury, the gold of Porcupine and Kirkland Lake, and the iron ore of Helen, Magpie and Moose Mountain mines.

Many other varieties of useful products are found in Ontario :—cobalt, iron pyrites, arsenic, quartz, graphite, talc, feldspar, mica, corundum, molybdenite, platinum, palladium, actinolite, apatite, fluorite, salt, gypsum, petroleum and natural gas.

Building materials, such as cement, brick, marble, limestone, sandstone, trap, lime, sand and gravel, are abundant.

Ontario in 1915 produced over 44 per cent. of the total mineral production of Canada, or more than twice that from any other Province. The preliminary report of the Ontario Bureau of Mines shows the output of the mines and metallurgical works of Ontario for the year 1915 to be worth \$57,532,844, of which the metallic production was \$47,721,180. There were 79 producing mines, 62 of which operated at a profit.

The prospector can go almost anywhere in the mineral regions in his canoe ; the climate is invigorating and healthy, and there is plenty of wood and good water.

A miner's license costs \$5.00 per annum and entitles the holder to stake out in any or every mining division three claims of 40 acres each.

For list of publications, illustrated reports, geological maps and mining laws, apply to

HON. G. H. FERGUSON,

Minister of Lands, Forests and Mines,

Toronto, Canada.

SCREENS

FOR

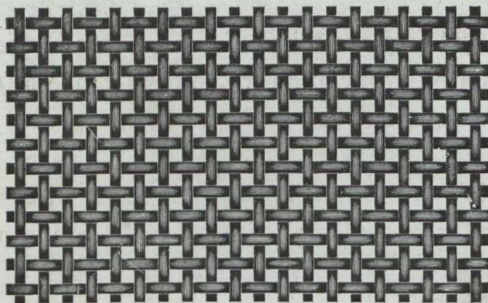
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