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PYRITES IN CANADA

The chief advertisements that the mineral industries of Canada have received have been derived from the exploitation of rich gold and silver deposits. While both Canadian asbestos and Canadian nickel occupy unique positions, yet neither has been the source of very much popular excitement.

It is not desirable that any branch of the mining industry in Canada should have to live down a period of foolish flotations and of disproportionate expansion. For many years the mining of iron pyrites has been going on quietly in Canada. The world's production of iron pyrites is about 2,000,000 tons. Canada's production is, roughly, 100,000 tons per year. In the United States not more than 300,000 long tons are produced. The United States, however, imports practically three-quarters of a million tons from Spain, and is, also, the chief market for the Canadian mineral. For instance, one-third of the pyrites produced in Canada is shipped to the United States.

Within easy reach of the Canadian producer there are at least twenty large firms that are posisble purchasers of the Canadian product. In Canada itself there are five corporations manufacturing sulphuric acid. The market for acid is growing at a rate far greater than is the mining of iron pyrites.

The whole situation as regards Canada has been carefully investigated and fully reported upon in the latest monograph of the Mines Branch, Department of Mines, Ottawa. Dr. Alfred W. G. Wilson, Chief of the Metal Mines Division of the Branch, is the author of that monograph. It is entitled "Pyrites in Canada, Its Occurrence, Exploitation, Dressing and Uses." It is a well-printed, carefully illustrated volume of more than 200 pages.

Dr. Wilson approaches his subject after he has, evidently, been fully seized of its commercial meaning. The uses of sulphuric acid are numerous. The reduction of silver ores and the refining of petroleum are two of the largest channels. Both are of primary importance. Either could form the basis of a substantial iron pyrites enterprise, where the pyrites was being used for the production of sulphuric acid.

But, more important than either of these two uses are the possibilities held out by the paper manufacturing trade. In Europe the pulp mills that use the sulphite process use also iron pyrites as the source of their sulphur. This is not the case in Canada. Imported crude sulphur is used here. Yet it is commercially feasible, and most probably it would be commercially profitable to use pyrites in lieu of sulphur. Not only would this save all the complications of international

carriage, but it would also make it possible for each manufacturer of pulp to secure and control his own supply of sulphur. Since Canada is becoming the largest supplier of pulp, the importance of her iron pyrites bodies is obvious.

GOVERNMENT CORE DRILLING IN NOVA SCOTIA

Encouragement vouchsafed to miners by governments takes various forms. Not the least interesting is that of assisting the prospector in drilling his property. In this direction the Government of Nova Scotia has been particularly active.

The Nova Scotia Department of Mines operates seven prospecting drills of the following general description: Two diamond drills actuated by steam, making cores of two and one and one-tenth inches diameter respectively; two hand diamond drills yielding cores of the smaller diameter mentioned; two steam calyx drills making a six-inch core, and one smaller calyx drill.

Upon the filing of a small bond and of a certified cheque for $250, any available drill is placed at the disposal of the applicant. The drill is then sent to the desired place and is operated under the direction of a person responsible to the Department. The location of the holes is left to the discretion of the applicant; all other matters are controlled by the Department employee.

All expenses, including shipment from and to the place of storing, are charged to the applicant, and, in no wise does the Department hold itself responsible for the manner in which drilling is performed. However, the applicant is given every reasonable consideration. He can make formal complaint at any time and can be sure of a hearing. Copies of the drilling log are filed at the Commissioner's office and similar copies are given to the applicant.

In the year ending September 31st, 1912, 77 holes were bored, at total footage of 10,826 feet. The cost per foot ranged from very low figures up to $2.46 per foot. In a future issue we shall analyze these costs. Meanwhile it may be pointed out that this kind of assistance to the prospector and miner is practical and sane.

THE ALBERTAN MINES BILL

In the course of the debate on the Mines Bill, now under discussion by the legislative body of Alberta, Mr. J. L. Cote, the member for Athabasca, made a strong plea for the establishment of a Provincial Bureau of Mines, with headquarters at Edmonton. Such a step, while commendable from every standpoint, may meet with objection on the ore score that the Dominion Government, having reserved the rights in the natural resources of the Province, the latter derives no direct revenue from its mines. Mr. Cote affirms, however, that the Province is entitled to the royalties on all coal mined under "road allowances," and this, he stated, would represent an annual revenue of not less than $100,000—a sum quite sufficient to maintain an efficient Provincial Bureau of Mines. Whether or not this contention is correct, it would still seem that any reasonable expenditure by the Province to establish and support such a department, would be thoroughly justified. In Alberta, agriculture is, of course, the principal industry, the total value of the production last year having been $38,400,000. Mining, however, comes second. The value of the coal production alone in 1912 was approximately $8,000,000. The production of cement represented at least $1,000,000, while there was a considerable production of lime, of brick and other clay products. These industries are developing at a very rapid rate; while in the utilization of non-metallic substances, at present disregarded, there are immense possibilities. For information respecting its mineral resources the Province is at present dependent entirely on the reports of the Dominion Department of Mines Such information is naturally limited. A Provincial Bureau could render a far more efficient service in this respect; and could, and undoubtedly would, do much to stimulate industry in new directions by indicating opportunities of which advantage has not yet been taken. It is meanwhile certain that the Western Provinces of Alberta and Saskatchewan will be ceded the control of their natural resources in the near future. The immediate establishment of an Albertan Bureau of Mines would merely anticipate, therefore, a need that sooner or later will have to be provided; but by organizing a department now it would be in a better position to meet the calls on it that changed conditions would create.

THE LABOUR QUESTION IN PORCUPINE

The somewhat complicated circumstances surrounding the labour situation in Porcupine call for a few words of explanation.

Some time ago a Mine Managers' Association was formed in the Pearl Lake section of Porcupine. To this Association the Hollinger Gold Mines, Limited, did not belong. Among the first steps taken by the Association was the reduction of the wages of workmen. A Board of Conciliation was asked for and obtained. The Board was convened. The result of its deliberations was substantially to uphold the rates set by the managers. This decision was rejected by the men.

The Hollinger management, which was not in any way represented in the Association, and which, consequently, had no voice on the matter, quite unexpectedly became the storm centre. On November 15th, 1912, a number of men, not employees of the Hollinger, came on the property at change of shift with the object of forcing the Hollinger miners to strike. In this they

were successful. In one day the working force of the mine was reduced from 478 to 118. The point to be remembered here is that the Hollinger management had absolutely no warning.

It had been maintained by the management that the men would be willing to continue work at current wages were adequate police protection provided. This, after the opening of the strike, proved to be the case. Under a guard supplied by the Provincial Police, work was rapidly resumed at the mine and little difficulty was experienced in obtaining men. Meanwhile, informations were laid against several of the agitators. Three cases were brought to trial. Two agitators, Cleary and Holowoskawe, were fined $500 each with the option of 90-day imprisonment, and a striker named Croft was fined $50 with an option of 60 days in jail. All three elected to go to prison. This occurred in January, 1913.

Notice of appeal was served by the defendants, which appeals will have been dealt with on March 26th. Meanwhile, however, the Dominion Department of Justice was petitioned by the miners to release the convicted men. Strange to relate, this request was promptly granted, and the men returned at once to Porcupine. We are credibly informed, further, that they immediately renewed the strike agitation.

Unless there be some occult reason for the action of the Department of Justice, we are convinced that nothing more derogatory to law and order could have been done. The offenders were given a fair trial. They were convicted. They deliberately chose imprisonment in lieu of paying their fines. It looks, therefore, very much as if the men had entire confidence in the leniency of the Department. Whether this be the case or not, it remains a fact that the whole machinery of justice in Porcupine has been made a laughing-stock.

If the so-called Lemieux Act, and it was under the provisions of this Act that proceedings were taken, is to be operative at all, it should be adhered to in letter and in spirit. If not, it should be wiped out.

Suppose, for example, that the managers were to hire "strong-arm" men to terrorize employees of companies that paid higher wages than did the Association. What would ensue can safely be left to the imagination. Yet the cases are quite parallel.

THE HOLLINGER STATEMENT

Under date of February 25, 1913, the president and the general manager of Hollinger Gold Mines, Limited, respectively, have issued statements covering the periods July 1st, 1912, to December 31st, 1912, and December 3rd, 1912, to February 11th, 1913.

Three dividends, each amounting to $90,000, were paid during 1912. The complete plant cost $606,223.54, and the sum of $302,639.19, which includes fire loss of $111,811.96, is charged to development. After disbursing $270,000 in dividends, writing off $106,225.54 from plant account, and $122,639.19 from development account, or $228,862.73 in all, the balance carried forward is $101,801.69. The net operating profits for the six months were $600,664.42. Two dividends have been declared since the end of the year. Taking into consideration the labour disturbances that hampered the management during November and December, this showing exceeds expectations.

Mr. P. A. Robbins' statement for the first six weeks of this year shows that 9,562 tons of ore yielded $240,-300, the average return per ton being $25.13. As the cost per ton is about $6 to $7, and as the capacity of the mill is now greater by 15 per cent., it will be seen that the present rate of production is ample for the continuation of monthly dividends.

EDITORIAL NOTES

On page 95 of our issue of February 1st, the bald announcement was made that four Nissen stamps were discarded by the Northern Customs Concentrator Company of Cobalt. This, as it happens, was quite unjust to the manufacturers of the Nissen stamp. The fact is that the four Nissen stamps have seen much duty and were worn badly. It was ,therefore, more expedient to replace them with the ordinary stamps of which the company had a supply on hand. In no sense was the incident a reflection upon the Nissen stamp.

According to recently published returns by the London Mining Journal, the average yield of ore milled last year on the Rand was 28s. 6d., or slightly under $7 a ton. This is rather below the estimate of 29s. 5d. made by Mr. Hugh F. Marriott in a communication to the Engineer and Mining Journal in January last. But in any event it is agreed that the yield per ton in 1912 was nearly a shilling greater than during the preceding year. This was largely discounted, however, by an increase in costs of eight pence per ton, costs in 1911 having been eighteen shillings. The profit per ton represented nine shillings and eight pence, or a penny more than was realized in 1911.

Tragic as is the position of Julian Hawthorne and his two associates, it is inconceivable to think that they could have persevered in their promotions for so long without knowing exactly what they were doing. Warning after warning must have reached them before they were brought to trial. While the Canadian Mining Journal was probably the first publication to draw attention to the character of their flotation, it was by no means the only one. It is a sad commentary on the ethics of Canadian newspapers that not a few of our leading dailies assisted the promoters editorially.

One of the most interesting and instructive papers presented at the recent annual meeting of the Canadian Mining Institute in Ottawa, was that by Mr. H. W. Dubois, of Philadelphia, descriptive of recent developments in connection with hydraulic mining in the Cariboo district in British Columbia. Rather over a year

ago Mr. Dubois, who is engineer for the Quesnelle Hydraulic Gold Mining Co., installed, despite the opposition of his board of directors, high carbon steel rolled plates as a lining for the sluiceways. These plates were half an inch thick and 58 inches square, the carbon content being from 0.80 to 1.20 per cent. Previous to the use of the steel plates the sluiceways had been lined with diorite blocks or boulders, which actually wore as much as eight inches in three weeks. After a whole season's operation the steel plates showed practically no wear. At first glance this difference would appear almost incredible, but the expalnation is found in the fact that the steel rapidly assumes an ice-like surface over which the material passes with a minimum of friction. The important effect of the installation was the reducton of operating costs to 2 cents per cubic yard of the material handled, or about one-half of the previous season's costs.

The advisability of increasing the field staff of the British Columbia Bureau of Mines was strongly urged in these columns some months ago. It is gratifying to uearn, therefore, that action in this direction has been taken, provsion having been made for placing two parties in the field this year in charge of competent assistants to the Provincial Mineralogist.

The discussion of the revision of the Banking Act promises to be more than a farce. The House of Commons Committee has called upon Mr. H. C. McLeod, former manager of the Bank of Nova Scotia, to give evidence. As Mr. McLeod has been the only outspoken advocate of the external audit, and as it is common knowledge that he dared to think for himself and to set at nought the Bankers Association, his evidence will mean something. The country is sick of the complacent platitudes of such admirable watch-dogs of the "interests" as Sir Edmund Walker. We make bold to suggest that representatives of the industries, particularly of the mining industry, be called as witnesses. Much light could be thrown upon the relation of banks and bankers to promotions, organizations and operation.

In the matter of profit distributions the mines of British Columbia made a better showing last year than for some time past; and there is now every promise that this record will be well maintained in the future. One of the several mines in this Province that paid handsome dividends to shareholders in 1912, was the Nickel Plate, at Hedley, in the Similkameen district, owned by the Hedley Gold Mining Company. According to the recently issued report of this company the ore treated last year averaged about $10.8, and yielded a net profit on the tonnage treated (70,455) of $385,880, of which $360,000, representing 30 per cent. on the capital, was distributed in dividends. With the showing now being made, there is every reason to expect a considerable revival of interest on the part of the investing public in British Columbia mining in the near future. At present the industry is on a sounder basis than at any previous time in its history.

GEORGE MATTHEY, F.R.S.

The death is announced, at eighty-eight years of age, of Mr. George Matthey, F.R.S., on February 14th. Mr. Matthey was throughout a long commercial life, keenly interested in the advancement of scientific technology. The industrial separation, purification and general manipulation of platinum and its associated metals formed the field of Mr. Matthey's labours.

The international metric commission which met in 1870 in Paris had for its object the construction and verification of a new series of standards formed of platinum with 10 per cent. of iridium. After considerable work and expense in purifying the metals the alloy was produced; but on further examination by chemical analysis, it was found to be impure and, consequently, useless for the purpose for which it was required. Mr. Matthey was then invited by the French Minister of War to attack the problem. He quickly commenced the work of producing large quantities of platinum and iridium of extreme purity, and later cast the ingots of the alloy in Paris. These ingots were submitted to most critical tests and careful analysis, and found to be precisely of the nature and composition required.

Mr. Matthey was then persuaded to devote his skill to the construction of the bars having the special type of cross-section which had been decided upon. To this end he purchased a second-hand lathe and set one of his skilled workmen to fashion the bars of the required cross-section. The bars produced were fully satisfactory. Copies of them were supplied to all the larger countries of the world, and they now form the standards upon which the metric system rests. Mr. Matthey was appointed a member of the Legion of Honour. He took great interest in the manufacture of the salts of platinum used in the production of platinum photographic papers.—A. G. B.

PERSONAL AND GENERAL

At the regular March meeting of the Council of the Canadian Mining Institute, held on March 4th, the following candidates for admission to membership were duly elected: Members—G. J. A. Buisson, Rossland, B.C.; Howard W. DuBois, Philadelphia, Pa.; Cadwallader Evans, Stellarton, N.S.; Thos. J. Flynn, Cobalt, Ont.; H. L. Forbes, Ottawa, Ont.; Gwynn G. Gibbins, Vancouver, B.C.; Chas. Spearman, Haileybury, Ont.; Bush Winning, Ottawa, Ont.; and Associates—Geo. C. Riley, Montreal, Que.

We congratulate Mr. C. V. Brennan, chief engineer of the Utah Con. Mining Company, of Bingham, Utah, on his recent marriage. Since his graduation from McGill four years ago, Mr. Brennan's career has been a brilliant one.

Mr. John McLellan, who is operating a small gold mine on one of the Queen Charlotte Islands, has returned from a visit to England.

Mr. Charles Fergie, of Montreal, left last week to inspect the collieries in Alberta for which he is consulting engineer. He will remain in the West for some weeks.

CORRESPONDENCE

"PERSONALS."

Home Life Building, Toronto, Ont.,
March 19th, 1913.

Editor, Canadian Mining Journal,
Toronto, Ontario.

Sir,—One cannot help but notice in reading the "Personals" in the various mining periodicals, the constant repetition in the names of engineers mentioned. This is undoubtedly a double hardship. It is unfair that a few engineers should bear the burden of sustaining this column by the constant and unwelcome use of their names, and it must be annoying to the editor to be compelled to repeat so often, and to lack in the supply of new matter for his readers. It occurs to me that if the busy or the modest engineer were furnished with adequate facilities for supplying this interesting information regarding himself and his whereabouts, it might largely act as a relief from this onerous burden.

With this in mind, I have drawn up an outline for a plan to furnish blanks to the various engineers,† which can be easily filled and posted to the journals. If these were properly elaborated they would reduce the labor of furnishing this information to a minimum, and would be a constant inducement to supply the various journals with this most important information.

I have simply attempted a meagre outline of a few of the paragraphs which should be included in this form. I leave it to your ingenuity and literary skill to enlarge, knowing that you are more capable of judging the necessities of the profession in this regard than I am. I suggest that if the subject were properly elaborated and copyrighted, it might be a permanent and large source of revenue.

Yours respectfully,

F. L. CURTIS.

Form "A"

.....has (returned from)
*(Name of Engineer) (gone to)
..... where he* .....
*(Name of place)
.....

Form "B"

.....has (resigned his)
*(Name of Engineer) (accepted a)
position with* .....
His many friends note with (pleasure) that*.....
(regret)
.....

Form "C"

(has gone to)
.....(has returned from)
*(Name) (is at)
.....*(He, or they if plural)
*(Name of place)
(is (or are) to make)
(is (or are) making) examination of.....
(has (or have) made)
.....*He says (or they say)*.....
.....

Form "D"

We are (pleased) to note that*.....
(sorry)
.....

*Note.—Please insert at place marked with an * and draw line through those words not necessary to convey meaning intended.

†The writer wishes to disclaim any intention of despatching engineers by parcel post.

THE NEW MINISTER OF MINES.

Louis Coderre was born at St. Ours, Quebec, on the 1st of November, 1865. His parents, Alfred Coderre and Emma Fontaine, were both French-Canadians. The former was superintendent of the locks at St. Ours from 1888 to 1898.

Mr. Coderre was educated at the Primary School, St. Ours, St. Hyacinthe, and Montreal Colleges, and Laval University, Montreal. On the 1st of July, 1895, he was married to Marie Anne Sophie, daughter of Edouard Ste. Marie, of St. Henri, Montreal. He has two sons and two daughters.

Serving as a law clerk with Mr. Pagnuelo—who is now a justice in Montreal, and graduating in 1912, he became a partner in the firm of Primeau and Coderre. At the present time he is one of the firm of Coderre, Fortin and Coderre. In 1885, he was appointed City Solicitor for St. Henri, retaining the position until St. Henri was merged in Montreal.

Mr. Coderre was also legal adviser to Ville Emard from 1906 until it was annexed to Montreal. For five of the Montreal Bar, which is an elective office.

Although Mr. Coderre has always taken an active interest in political life, both legal and national, he did not seek any public office until June, 1908, when he ran against Mr. Decarie, in Hochelaga, for a seat in the Quebec House. He was defeated. Again in October of the same year he was candidate against Mr. Rivet, the Liberal candidate for the Dominion Parliament, but was defeated by a majority of only 185. In 1909, he sought office as a Controller of Montreal as an independent candidate, and was fifth in line for position, but as only four Controllers were to take seats he was again left on the outer circle of success. At the general election, September 21st, 1911, Mr. Coderre ran as the Conservative candidate against his old opponent, Mr. Rivet, and polled a majority of 1,373.

He is a Conservative in politics, a Roman Catholic in religion, and resided in Montreal.

CANADIAN MINING INSTITUTE ANNUAL MEETING 1913.

DR. A. E. BARLOW'S PRESIDENTIAL ADDRESS

(Continued from last issue.)

In 1846, owing to activity in prospecting and locating mineral lands on the southern shore of Lake Superior, and a favourable report by Mr. W. E. Logan, then (1842) newly appointed Provincial Geologist, some enterprising Canadians banded themselves together into two associations called "The Montreal Mining Company" and the "Upper Canada Mining Company." The former company having purchased, amongst others, what was then known as "The Bruce Mines Location," while the Upper Canada Company proceeded to develop the Wallace mine, the first place in Canada in which nickel had been discovered. The Montreal Mining Company continued operations from 1846 to 1865, when, from a variety of causes, the work proved unremunerative.

These early references to attempts to carry on mining operations, while instructive and interesting, have only an indirect bearing on the present status of the industry. The real inception of mining may be said to date from the completion of the constructon of the Canadian Pacific Railway in 1885. This rendered accessible a vast territory, much of which was underlaid by mineral bearing formations. Since then progress has been rapid and well sustained. It is thus interesting to note that in 1886, the first year for which complete statistics of the mineral production for the whole of Canada were collected, the value was reported as $10,221,255, or about $2.23 per capita. In the succeeding ten years the value of the mineral production had increased over 100 per cent. representing the sum of $22,474,256, or $4.38 per capita in 1896. Chiefly as a result of gold mining activity in the Yukon, the increase in the next five years was nearly 200 per cent., the total value of mineral production in 1901 being $65,797,911, or $12.16 per capita. For the three years following there was a slight decrease from this amount, but in 1905 a very substantial increase was made the total value of the mineral production in this year being $69,525,170. From this year, the increase was steady and rapid until 1910, when the grand total registered was $106,823,623, averaging $14.93 per capita of population. In 1911 the mineral production showed a decrease of a little over 3 per cent. as compared with that of 1910, the total amount being valued at $103,220,994, or an average output per capita of $14.42. In 1912 there was again a very large increase, the total value amounting to about $133,127,489, or over $18 per capita.

Ontario has now taken her place as the premier province in mining of the Dominion, having passed British Columbia in 1909. The relative importance of the provinces as mineral producers for 1912 are as follows: Ontario contributed 38.33 per cent.; British Columbia, 22.20; Nova Scotia, 14.15; Quebec, 8.77; Alberta, 9.10; Northwest Territories, 4.42; while Manitoba, New Brunswick and Saskatchewan together only accounted for 3.03 per cent. of the total mineral output. As is probably well known to all of you present, Ontario is famous for its production of silver, nickel, copper, natural gas, cement and clay products; British Columbia for coal, gold, copper, silver and lead; Nova Scotia is chiefly noted for its coal and gypsum, and also in a minor degree, gold, stone and clay products. Asbestos accounts very largely for the Quebec mineral products, although graphite, cement, stone, copper and pyrites figure rather prominently, especially the three first mentioned products. Alberta's production is largely made up of values obtained from its coal, cement and clay products.

The mineral products of the Yukon are gold and coal, with some silver and copper. Manitoba produces gypsum, clay and stone products; Saskatchewan, coal and clays, while New Brunswick, which is the last on the list of provinces as a mineral producer, has chiefly gypsum, coal, iron and stone products.

The construction of the Canadian Pacific Railway was directly responsible for the discovery of the Sudbury nickel copper deposits, a mineral field which has, up to the present time, produced a total value of about 80 millions of dollars.

In 1877 asbestos was discovered in the serpentine hills of Thethford and Coleraine in Quebec, but it was not until 1884 that mining had made such progress that 1,141 tons were quarried, valued at $75,097. In 1912, the total production of asbestos was 111,175 tons, valued at $3,059,084, while the aggregate production to the end of the year had reached a value of nearly $35,000,000. Quebec now contributes more than 75 per cent. of the world's total production of asbestos.

It was not until 1890 that claims were located on the gold-copper lodes which have made Rossland famous as a mining camp, and attracted attention to the whole interior of southern British Columbia. Since that time the production from this district alone has been more than $55,000,000.

The discoveries at Rossland stimulated prospecting over extensive areas in southern British Columbia, and in 1891 the ore bodies in the vicinity of Greenwood and Phoenix in the Bomdan district were located. About the same time coal mining was becoming quite extensive in Alberta; while although the Klondike District of the Yukon was discovered in 1894, it did not become prominent until 1896. All of these discoveries and consequent active mining development work greatly stimulated interest in the mineral and the other natural resources of the country.

This period marked the real beginning of that considerable expansion which has since been so extraordinary. Cobalt was discovered in 1903, by the building of the Temiskaming and Northern Ontario Railway, and to the end of 1912 has produced nearly 32 million dollars worth of silver.

More interesting, however, than this brief narration of the marvellously rapid development of the mineral industry of Canada, are its future possibilities. None of us can realize the truly magnificent future of this vast Dominion, with an area greater than that of the United States, and almost equal to that of the whole of Europe. Two-thirds of this total area of Canada (3,729,665 square miles) is underlain by rock formations which, where adequately examined and prospected, have been found to contain exceedingly valuable, and in many cases, unique mineral deposits. In attempting to predict the future of the mineral industry of Canada, we have a few outstanding facts that should be of great assistance in this connection.

The Great Canadian Shield, or Protaxis, of North America, is a term in general use to designate the

great V-shaped area of Pre-Cambrian rock which surrounds Hudson's Bay, extending from Labrador almost to the mouth of the Mackenzie River. The area of this great mass of very ancient crystalline rocks has been estimated at 2,000,000 square miles. Along the southern border it contains the nickel deposits of Sudbury, which contributes more than 70 per cent. of the world's supply of nickel, and which, in the near future owing to alterations and extensions undertaken, is likely to be more than doubled. At Cobalt are the world-famous silver deposits, whose development has given Canada third place in the world's silver producing countries. In the extension of these pre-Cambrian rocks into the United States, southwest of Lake Superior, are found the greatest iron mines in the world, with an estimated available ore of 1,950,000 tons, to which must be added 20.5% which had been consumed up to the close of 1910. In this area is situated also a copper camp which in the total of its production is the greatest in the United States. It is believed that similar copper bearing rocks, occupying a still greater area, and likely to be at least as richly productive, occur in the vicnty of Coronaton Gulf and Bathurst Inlet in the Arctic Ocean. A description of this mineral bearing area, from information then available, was given last year by one of our members, Mr. J. B. Tyrrell (Trans. Can. Min. Inst. Vol. xv., pp. 508-534. At this meeting Dr. James Douglas will give a detailed statement of the results of an exploration which has recently been conducted under his auspices. In these circumstances, therefore, it seems entirely reasonable to assume that these great northern areas contain vast deposits which will become available with the opening up of the country, and consequent furnishing of transportation facilities.

The immense possibilities of Canada from an agricultural standpoint are now a matter of general agreement, but the potentialities of mining in Canada are not so commonly known. It is the speaker's firm conviction that Canada's future greatness will depend more upon her mineral production than upon any other of her natural resources. Many of us have an abiding faith in the great lone northland, with its apparently barren and waste sketches of rock and water. The call for its successful development is as compelling as the missionaries' cry which came over from Macedonia. National greatness can only be achieved by obeying this mandate. An empire, half a continent, awaits the march of civilization. We may not falter or hold back.

INTERNATIONAL GEOLOGICAL CONGRESS

Meeting of Organization Committee, Ottawa, Tuesday, March 4th, 1913.

The Organization Committee of the Twelfth International Geological Congress met at the Chateau Laurier, Ottawa, at 10.00 a.m., on Tuesday, March 4th, 1913.

Present—Dr. Adams, President, in the chair; R. W. Brock, General Secretary; W. S. Lecky, Secretary; and Messrs. M. B. Baker, A. E. Barlow, D. D. Cairnes, C. Camsell, A. A. Cole, A. P. Coleman, T. C. Denis, D. B. Dowling, J. A. Dresser, E. Dulieux, E. R. Faribault, W. F. Ferrier, W. L. Goodwin, Abbe R. C. Guimont, Eugene Haanel, E. Haycock, E. D. Ingall, E. M. Kindle, C. W. Knight, Lawrence M. Lambe, W. W. Leach, O. E. LeRoy, G. G. S. Lindsey, R. G. McConnell, J. McEvoy, W. McInnes, J. McLeish, W. G. Miller, W. A. Parks, J. B. Porter, W. Fleet Robertson, F. H. Sexton, J. B. Tyrrell, T. L. Walker, James White, A. B. Willmott, G. A. Young.

There were also present by invitation the following gentlement who are leaders of excursions: Messrs. J. W. Goldthwait, W. A. Johnston, Percy E. Raymond, John Stansfield.

Absent—Messrs. J. A. Allan, H. M. Ami, J. A. Bancroft, A. G. Burrows, Eugene Coste, R. D. Falconer, R. P. D. Graham, R. R. Hedley, R. A. A. Johnston, Joseph Keele, H. Mortimer-Lamb, G. F. Matthew, W. Nicol, J. T. Stirling, R. C. Wallace.

Mr. Frank B. Taylor, leader of one of the excursions had also been invited to attend, but was unable to do so owing to serious illness in his family. Dr. John M. Clarke, a leader, had also been invited but was unable to attend.

Minutes of Meeting of December 2nd, 1910.

The minutes of the inaugural meeting which took place on December 2nd, 1910 were read for the information of the Organization Committee:

Minutes of the preliminary general meeting held in Toronto on the second day of December, Nineteen Hundred and Ten to appoint the executive Committee of the Twelfth International Geological Congress, adopted as the minutes of the first executive meeting.

At the instance of the Director of the Geological Survey a meeting of Canadian geologists and Mining Engineers, was called for December 2nd, at 11 a.m., in Toronto to arrange for the Twelfth International Geological Congress, which is to be held in Canada.

There were present Dr. F. D. Adams, Mr. J. C. Murray, Mr. O. E. LeRoy, Mr. H. Mortimer-Lamb, Mr. J. A. Bancroft, Prof. E. Dulieux, Dr. T. L. Walker, Prof. M. B. Baker, Mr. J. B. Tyrrell, Mr. James McEvoy, Dr. W. G. Miller, Dr. W. A. Parks, Mr. J. McLeish, Dr. A. P. Coleman, Mr. R. G. McConnell, Mr. G. G. S. Lindsey, Mr. O. N. Scott, Mr. W. McNeill, Mr. W. S. Lecky, Mr. R. W. Brigstock, Mr. F. Loring, Mr. A. A. Cole, and Mr. R. W. Brock.

Dr Adam called the meeting to order and ex- and Mr. R. W. Brock, Secretary.

Dr. Adams caleld the meeting to order and explained the object. On motion of Dr. Miller, seconded by Dr. A. P. Coleman it was decided that the Congress should be held in Canada in 1913, this date being chosen on account of the British Association Meeting in Australia in 1914, and possibly the Winnipeg Exposition in Canada, also in 1914. The meeting then proceeded to elect officers for the Congress.

On motion of Dr. Miller, seconded by Dr. Coleman, Dr. Adams was elected President. Dr. Coleman moved and Mr. James McEvoy, seconded that Mr. R. W. Brock be elected Secretary, Dr. Miller and Mr. Tyrrell suggested that the offices of treasurer and secretary be combined. This was included in Dr. Coleman's motion and the motion thus amended was carried. On account of the

great amount of work which would be necessary to make the meeting a success it was decided that a paid secretary or manager should be appointed to assist the secretary and Executive Committee.

The question of committees was then discussed, but it was decided that before these could be formed it would be necessary to decide upon the place of meeting.

Dr. Miller moved, seconded by Dr. Parks that the Congress be held in Toronto. This motion was carried.

In the discussion the point was brought out by Dr. Walker that local meetings might be held in the east and west as well as the main meeting at Toronto. This suggestion met with the approval of the meeting.

The discussion regarding committees was then resumed. In the course of the discussion it was was brought out that a large honorary committee, a large general committee, local committees, and an executive committee would be necessary. As a great deal would depend upon the careful selection of these committees it was decided to appoint a small executive committee who could spend some time and thought on the selection of the other committees. It was moved by Dr. Miller and seconded by Mr. LeRoy and carried, that the President, Secretary, Dr. Coleman and Mr. Tyrrell should be apointed a committee to recommend to this meeting names for an executive committee. It was moved by Dr. Miller, seconded by Mr. McEvoy that Dr. Coleman and Mr. Tyrrell be members of the executive committee. The committee nominated then retired and after fifteen minutes consultation recommended the following names as an executive committee: F. D. Adams, R. W. Brock, A. P. Coleman, J. B. Tyrrell, W. G. Miller, O. E. LeRoy, W. McInnes, T. Denis, W. A. Parks, G. G. S. Lindsey. The convener pointed out that the names were confined to persons living in the central part of the country on account of the necessity of the committee meeting at frequent intervals.

It was moved by Mr. Cole, seconded by Mr. McEvoy that the gentlemen recommended be appointed an executive committee of the Geological Congress with power to add to its members.—Carried.

Dr. Walker moved that the general committee, honorary committee and any other committees that might be found necessary be appointed by the Executive Committeee. This was seconded by Mr. M. B. Baker, and carried.

Dr. Walker moved, seconded by Dr. Miller that the Executive Committee be authorized to appoint vice-chairmen of committees who could act in case of the absence of the chairman.

An informal discussion then took place regarding the excursions which it was felt should be the main feature of the Congress in Canada. Various suggestions were made and it was decided to have the members consider this question carefully and send their suggestions to the Executive Committee who would go thoroughly into the matter.

On the question of major subjects for the Congress, it was felt that it might be advisable to get up a special memoir on coal similar to the one on the Iron Ores of the World prepared for the past Congress, as this subject would be supplementing the Iron Memoir.

The secretary stated that Dr. J. G. Anderson, secretary of the Eleventh Congress, had called attention to the fact that the Congress had accepted the proposal of Dr. Hobbs that an international inquiry on the subject "The Fracture System of the Earth's Crust" should be undertaken; that Congress in accepting this proposal expressed its opinion that the manner employed by the Swedish executive committee when undertaking inquiries on the iron resources and the post-glacial climate could serve as a model to the coming executive committee of Canada when organizing the proposed enterprise, and charged the named committee to arrange the matter with Dr. Hobbs.

The subjects for the Congress were left to the executive committee.

The meeting then adjourned to attend a lunch given by the Toronto Branch of the Canadian Mining Institute.

Communications From Absentees.

The President read letters of regret from absentees.

The General Objects and Work of the International Geological Congress.

The President briefly outlined the general objects and work of the International Geological Congress. As information on these subjects is contained in the Canadian Edition of the Second Circular which will be in the hands of members in a few days time, it is not repeated in these minutes. The President mentioned the splendid work which had been accomplished in the course of the different sessions, both in pure and applied geological science and which had resulted in such important publications as the Geological Map of Europe and the Monograph on the Iron Ore Resources of the World, the latter of which had been instrumental in starting new industries in various countries. In his closing words the President pointed out that the Twelfth or Canadian Session would accomplish its mission if it were successful in giving to the world in easily accessible form the results of geological research since the time of its last session and in particular he mentioned the publication which had been in preparation now for more than two years of the Coal Resources of the World. He hoped that the Canadian Geologists and particularly the younger members of the profession would gather great help and inspiration from meeting so many celebrated men from various countries.

Arrangements for the Twelfth Session.

The General Secretary, Mr. R. W. Brock, outlined briefly the manner in which the Congress had been asked to hold its Twelfth Session in Canada and the general arrangements made up to the present time. The Congress had been invited by the Government of Canada, the invitation being officially transmitted through the foreign office and through the British Ambassador in Sweden. The Government invitation had been supported by the Province of Ontario conveyed personally at the Eleventh Session in Stocholm by Dr. Miller, the Provincial Geologist of Ontario and by the Canadian Mining Institute by the then President, Dr. Adams, who also on this occasion represented the Government of Canada and by the Royal Society of Canada.

The Government of Belgium had invited the Congress to hold its Twelfth Session in that country but the Canadian invitation, which was made for the second time, having previously been made in 1907 was accepted.

On December 2nd, 1910 an inaugural meeting was held in Toronto, the minutes of which were read to-day. It was called at the instance of the speaker acting for the Government as the Director of the Geological Survey. At it were present representatives of the Institutions who had invited the Congress to be present in Canada and as shown from the minutes of the meeting a small executive committee was appointed with instructions to appoint such other committees as might be required as and when they were required.

Committees dealing with the following subjects have been appointed: Coal Resources, Editorials, Excursions, Finance, Leaders of Discussions, Official Invitations, Patronage, Publications, Qualifications for Membership, Toronto Local, Transportation, and a committee to appoint an Assistant Secretary. Some of these committees have completed their work and have been dissolved but most of these are still active and consist of one or two members of the Executive Committee with in some cases other gentlemen but in each case they report direct to the Executive Committee which makes itself responsible for the financial arrangements. The Organization Committee had also been appointed and was meeting to-day for the first time.

With regard to the Monograph on the Coal Resources this will consist of 1,200 pages published in three volumes accompanied by an atlas of 70 maps. The work was well under way under the editorship of Messrs. William McInnes and D. B. Dowling and there was every reason to believe that it would be published in time and be a credit to the country.

The excursions would, no doubt, be the leading feature of the Congress and every effort is being made to make them attractive both to geologists and mining engineers. The itineraries of the excursions were contained in the second circular which was in the hands of the committee and it was therefore unnecessary to detail them. The guide books would consist of fifteen volumes comprising a total of more than 1,600 pages and a large number of maps. The manuscripts for the guide books were all completed with one exception and most of the material is in the hands of the printer and has reached the stage of galley proofs.

Co-operation of the Mines Branch.

Dr. Eugene Haanel stated that as the excursions had already been planned and the routes made up he was a little at a loss to know in what way he could assist but he pointed out that there were on his staff men than whom there were none better qualified to serve as guides on the excursions, for example, there were on his staff one mining engineer who had made a study for the last three years of the copper resources of the Dominion and another who had made a specialty of mica and another who had made a study of iron ore deposits. Dr. Haanel assured the committee that he would give the Congress his hearty support

and active assistance and would be glad for members of his staff to act as guides and to assist in the excursions. Dr. Haanel added that he thought that some of the monographs or summaries of the monographs published by the Mines Branch would be useful for distribution at the meeting and he stated that he had, in anticipation of the meeting, ordered a large number of Dr. Coleman's map of the nickel-copper deposits of the Sudbury district.

The President thanked Dr. Haanel very heartily for his promised assistance and pointed out that as this was a Geographical Congress we had not been able to make mining the principal object of any excursion but that in most of the excursions it was a very important incidental object and that as many visits to the mines and mineral deposits as possible would be made and that in connection with these the committee would take advantage of Dr. Haanel's kind offer and secure assistance from the members of his staff. Dr. Adams also pointed out that while the general routes and the leader of each excursion had been settled the list of guides had not been settled and also the routes and points to be visited were open to alterations. The Executive Committee would be glad to receive suggestions. Dr. Adams expressed a hope that the International Mining Congress which held its next meeting in 1915 in England could be induced to meet in Canada in 1920 when mining would be the principal object of the excursions.

The Tenth Session in Mexico in 1906.

Dr. W. G. Miller gave a short address on the Tenth Session which was held in Mexico in 1906. He dwelt upon the generous support given by the Mexican Government in the way of money grants, free transportation on railways, great reduction in fares on steamers, etc. He was of the opinion that we could not hope to equal the brilliant social side of the Tenth Session and spoke feelingly of the hospitality of the Mexican people. The outstanding achievements had been:

(1). The guide books which had been pubilshed, giving exhaustive information on mining areas in Mexico.

(2). The Geological map of North America which had been so favourably commented upon by the technical papers.

The Eleventh Session in Sweden in 1910.

Dr. A. P. Coleman gave an account of the Eleventh Session held at Stockholm, Sweden, in 1910. Dr. Coleman mentioned that while French was the official language of the Congress, English and German seemed to be predominant. The Swedes had made their preparations a long time ahead and their arrangements were carried out as planned and they had shown wonderful organizing ability which it would be hard to equal in Canada. The only criticism he had to make was on the belated publication of the "Compte-Rendu" which appeared more than two years after the Session. He thought that Canada ought to do better in this respect.

Financial Requirements of the Twelfth Session.

Mr. G. G. S. Lindsey, chairman of the Finance Committee mentioned that the Executive Committee had been promised about fifty thousand dollars and that they expected to require about seventy-five thousand, all of which was needed for the general purposes of the Congress. Money necessary for local entertainments must, in his opinion, be raised locally.

The list of Honorary Councillors would be printed in the Canadian Edition of the Second Circular which had recently been destroyed by fire and he thought that the Honorary Councillors could be approached for financial support in the matter of local entertainments and local expenses.

Mr. Lindsey mentioned that the central part of the Twelfth Session would, in his opinion, be the excursions and he considered it to be the duty of the leaders to see that the social side of the excursions be properly conducted and that on a high standard.

Duties of the Organization Committee.

The General Secretary read the following report enumerating the duties of the Organization Committee and this report was adopted without discussion.

"It has been the custom of previous geological congresses to have a general Organization Committee consisting of from thirty to sixty members who were, as a rule, well known geologists or mining engineers of the country in which the Congress was being held.

"In the case of the Twelfth Session a general meeting was called on December 2nd, 1910, and it was there decided that owing to the long distances in Canada it was best to elect a small central committee that would act as an Executive Committee and to give this Executive Committee authority to appoint any other committees that might be necessary.

"The Executive Committee, towards the end of last year, felt that it was time to have a more general committee and therefore asked various gentlemen throughout Canada to become members of the Organization Committee with the results of which you are aware.

"The chief duties which the Executive Committee had in mind for the Organization Committee were:

1st. The formation of local committees at various points which excursions of the Congress will visit.

2nd. General assistance in making arrangements for the Congress and in carrying out these arrangements.

3rd. Assistance, if necessary, in raising funds to assist in financing."

Duties of Local Committees.

The General Secretary read the following report which was adopted without discussion.

"Local committees will be formed at the instance of members of the Organization Committee or in places where there are no members of the Organization Committee then by arrangement with the Executive.

"The duties of the local committees are to make all necessary local arrangements acting in co-operation with the Executive Committee and with the leaders of excursions. Before any arrangement is actually complete it should be communicated to the Executive Committee through the secretary in order that there shall be no confliction of plans.

"With regard to funds any entertainments or arrangements which are of a purely local character and which would not be undertaken by the Congress as a whole in the ordinary course of events must be financed locally but other liabilities, provided they have been previously approved by the Executive, will be assumed by the Executive. For example, the hire of carriages between the station and the point of interest which is planned in the excursion would, if necessary, be paid by the Executive Committee as the expenses would be considered part of the excursions. All local entertainments such as Indian plays which are of purely local interest and supposed to be offered by the people of the place would have to be financed locally.

"At the time of the excursions it is expected that the Executive will be represented on each excursion by a secretary and if this plan is carried out the local committee will deal direct with the secretary of the excursion in each case.

"In the formation of local committees it is requested that local branches of the Canadian Mining Institute as well as various scientific societies as far as possible, be represented. Local committees should not be too large or if it is found advisable to have large committees then an executive should be chosen to carry on the work."

Places at Which Local Committees are Necessary.

The General Secretary read a list of places at which local committees were necessary. This list was added to by various members of the committee present and the following list was adopted it being understood that local committees can be formed at any other places as and when required.

Nova Scotia—Sydney, Halifax.

New Brunswick—St. John, Moncton.

Quebec—Quebec, Sherbrooke (for the Eastern Townships), Montreal.

Ontario—Ottawa, Toronto, Kingston, Sudbury, Niagara Falls, Hamilton, Collingwood, Cobalt, Porcupine, Kenora.

Manitoba—Winnipeg.

Alberta—Medicine Hat, Calgary, Edmonton.

British Columbia.—Nelson, Kamloops, Vancouver, Victoria.

Yukon Territory—Dawson City.

Dr. Goodwin thought it advisable to add Michipicoten to the list and that a visit should be paid to this district, Dr. Goodwin thought that the Lake Superior Corporation would be very glad to assist and that we could visit Sault Ste. Marie and that we could travel by the Algoma Central Railway to Michipicoten and then reach the main line of the Canadian Pacific Railway at Hobon.

Mr. J. A. Dresser stated that he was quite sure that the Lake Superior Corporation would be glad to do anything in their power and the Algoma Central Railway had already promised transportation facilities should we require them. It was finally decided to leave the question of an excursion to Sault Ste. Marie and Michipicoten to the Executive Committee.

Special Names to be Placed on Local Committees.

The General Secretary read a geographical list of members of the Organization Committee, Honorary Councillors, and Leaders of Excursions. It was thought that local committees could be formed from this list with such other persons as it may be considered advisable to ask.

Mr. James White stated that in each place where there is a branch of the Canadian Mining Institute the chairman of such branch should be added to the committee. Various other names were suggested including Sherbrooke: Mr. George R. Smith of Bell Asbestos Mines and Col. J. J. Penhale. Victoria: Mr. W. J. Sutton, chairman and E. Jacobs, secretary, Western Branch of the Canadian Mining Institute. Winnipeg: A. J. Merrill, member of the Canadian Institute and T. R. Deacon, Mayor of Winnipeg, member of the Canadian Society of Civil Engineers and at one time considerably interested in mining.

Regarding the formation of local committees, an animated general discussion took place in which most of the members present took part. It was finally decided on the suggestion of Mr. Lindsey that the members of the Organization Committee and Leaders of Excursions present should meet after lunch and arrange for the local committees by forming themselves into groups according to Provinces.

Extraordinary Duties of Any Particular Local Committee.

Various local committees will have special duties peculiar to themselves and not provided for in the general duties. As examples of this the General Secretary read the following notes:

The Toronto Local Committee will have a great many extra duties incidental to the fact that the Congress is meeting in Toronto.

A day is spent at Ottawa, and the Ottawa Local Committee will be expected to assist in securing suitable hotel accommodation.

A day will be spent in Montreal, and the Montreal Local Committee will be expected to assist in securing suitable hotel accommodation.

It is possible that the train for excursion C. 2 will have to be shortened at Kootenay Landing, and if this is the case the Nelson Local Committee will be expected to find accommodation for the members who are deprived of their sleeping cars.

Financial Requirements.

This matter had already been dealt with in Mr. Lindsey's address earlier in the morning and Mr. Lindsey stated that he had nothing further to add to his remarks.

Programme of the Twelfth Session.

The programme of the Twelfth Session as printed and distributed on February 7th, was read and adopted, subjects to such revision as may, from time to time, be necessary.

Local Memorial.

In the temporary absence of Dr. Barlow, who had an appointment in connection with the Canadian Mining Institute meetings, Mr. Brock read the following memorandum from the Minutes of the Thirteenth Meeting of the Executive Committee, held in Ottawa on February 1st.

"Dr. Barlow reported that this Committee recommend that a memorial plate be erected in Perce on the occasion of the visit of the Congress and that a tablet be placed in the Victoria Memorial Museum on August 1st on the occasion of the visit of the Congress and that the expenses be defrayed by subscriptions from members of the Organization Committee. It was left to the Logan Memorial Committee to continue their work regarding the memorial, including the subscriptions to be secured."

He estimated that the cost of the two tablets would amount to a total of about three hundred dollars, which amount should be collected by the Organization Committee.

Mr. Ferrier thought that this amount could easily be secured from the members and ex-members of the Geological Survey. Mr. Brock replied that in his opinion the memorial to the late Sir William Logan would be more honoured if the subscriptions were collected from a wider circle.

The President spoke in the same strain pointing out that it was originally the suggestion of Dr. John M. Clarke, a former member of the Geological Survey of Canada. Dr. Clarke's suggestion being that in the course of excursion A.1. a tablet should be erected at Perce where so much of Sir William Logan's work had been accomplished.

Dr. Barlow, who had now returned, made a few remarks eulogizing Sir William Logan as one of the greatest economic and scientific geologists. Dr. Barlow was of the opinion that the amount required should be raised by subscriptions from the Organization Committee.

Mr. Ferrier suggested the erection of a rough stone monument with a tablet in front of the Museum in Ottawa. After further discussion it was moved by Mr. W. Fleet Robertson, seconded by Mr. W. F. Ferrier and carried:

That the Logan Memorial Committee consisting of Messrs. Barlow, Brock, Coleman and Miller be instructed to proceed with the arrangements for the erection of suitable memorials to the late Sir William Logan, the locations and characters of the memorials to be left to the named committee and that the members of this Organization Committee guarantee the expenses up to the sum of five hundred dollars.

Announcement of Afternoon Session.

The President announced that the Leaders of Excursions were to meet in the afternoon at 3 p.m., and that after this meeting there would be another meeting of the Organization Committee to consider the reports of the provincial sub-committees regarding the local committees which were to be made by the provincial sub-committee who were also to meet this afternoon acting on Mr. Lindsey's recent suggestion.

The meeting then adjourned.

Luncheon.

Luncheon was served in a private dining room at the Chateau Laurier at 1.10 p.m. The Right Hon. R. L. Borden, and the Hon. Frank Cochrane, two of the Honorary Vice-Presidents were present and made brief addresses in which they assured the members of the committee both of their personal and official interest in the Congress. After the luncheon the Ministers made a point of meeting many of the members and discussing the Congress affairs with them.

Afternoon Meeting—Local Committees.

As arranged before luncheon the members of the Organization Committee formed themselves into groups according to Provinces and discussed the matters of Local Committees and additional Guides to excursions.

The Organization Committee met again about 5 p.m., to consider these reports and various Local Committees were suggested and names added. As this matter has, necessarily, to be proceeded with further the list is not given in these minutes, but when further completed will be printed and distributed in the form of a separate leaflet.

The President's Closing Remarks.

The President took occasion to state that the Executive Committee would be glad to receive special reports dealing with subjects of geological or mining interest for distribution at the time of the Congress. He mentioned that it would be a good policy for commercial companies connected with the mineral industry to have a number of descriptive pamphlets prepared for the use of members of the Congress. He also mentioned that at the Swedish Congress picture post cards had been printed and distributed which showed scenes of particular beauty or mineral or geological features of interest.

The meeting then adjourned.

R. W. BROCK, General Secretary. W. S. LECKY, Secretary.

THE "DE RE METALLICA" OF GEORGIUS AGRICOLA.*

A REVIEW

In the pride of our modern achievements we are prone to look with pitying eye upon the seemingly meagre progress made by man in centuries past. It tittivates our self-esteem to believe that we are whole heavens above the generations that have gone. A wise Providence has ordained, however, that we should not be without salutary lessons in humility. And it is with much humility that the readers of **De Re Metallica** turns the last page of that remarkable book.

Three and one-half centuries, ago, Georgius Agricola, a native of Saxony, gave to the world the first edition of "De Re Metallica." To be exact, the work appeared in the year 1556. It was the fruit of twenty years' investigation, observation and practice, and it embodied the best current knowledge of mining and metallurgy. Nor was it superseded until more than two centuries had elapsed.

Strange to relate, this noble volume, which was written in Latin, was translated only into German and Italian. Dating not later than the latter part of the seventeenth century, all these translations were inaccurate and inadequate. Particularly was this the case with the first German translation.

Briefly, although in a general way, Agricola's *magnum opus* has been known to the scientific world for long, and although there are many Latin copies extant, yet until now no brave spirit has girded up his loins for the task of rendering it into any modern language. Thus there has remained almost unseen and unused one of the chiefest jewels of scientific literature.

It has remained for a mining engineer, well known to all readers of current technical books, assisted by his wife, to open for us the treasure-house of **De Re Metallica.** Mr. Herbert Clark Hoover, whose name is familiar to us as the author of "**Principles of Mining,**" and his wife, Lou Henry Hoover, are the two devoted transliteraters of Agricola. To them we owe the appearance, belated but all the more welcome for that, of the magnificent volume that has just been issued in London. Mr. Hoover is a particularly sane and thorough engineer and writer. Mrs. Hoover, by a most fortunate accident, is an accomplished Latinist, and, in addition, a person of much scientific knowledge. No combination could have been more fortunate. Five years of intermittent, though arduous, labour were devoted to the execution of the idea—an idea conceived and carried out entirely in the interests of scholarship.

"We do not present **De Re Metallica,**" say the authors in their preface, "as a work of 'practical' value. The methods and processes have long since been superseded; yet surely such a milestone on the road to development of one of the two most basic of human industrial activities is more worthy of preservation than the thousands of volumes devoted to records of human destruction. . . . . If the work serves to strengthen the traditions of one of the most important and least

*Georgius Agricola De Re Metallica.—Translated from the first Latin edition of 1556 with Biographical Introduction, Annotations, etc., etc., by Herbert Clark Hoover and Lou Henry Hoover.—Published for the Translators by the Mining Magazine, London.—For sale by The Canadian Mining Journal, Toronto, Canada.

recognized of the world's professions we shall be amply repaid."

* * * * *

As mentioned above, Agricola spent twenty years in gathering and collating material for his book. It is a workmanlike survey of mining and metallurgy as they were practised in his day. The admirable clarity of his mind, and his equally admirable freedom from the charlatanism, superstition, and sciolism of his age are outstanding qualities. Not the least manifestation of his genius is the facility with which he coins factitious Latin names for implements and phenomena never christened by the Romans. But most interesting of all is the evidence, shown on almost every page, of the fact that the author had the real good of the mining industry at heart and that he had resolved to neglect no manifest detail that might make his presentation clearer to his readers.

De Re Metallica is divided into twelve books. "The first book," to quote Agricola's own words, "contains the arguments that may be used against this art [mining], and against metals and the mines, and what can be said in their favour. The second book describes the miner, and branches into a discourse on the finding of veins. The third book deals with veins and stringers and seams in the rocks. The fourth book explains the method of delimiting veins, and also describes the functions of the mining officials. The fifth book describes the digging of ore and the surveyor's art. The sixth book describes the miners' tools and machines The seventh book is on the assaying of ore. The eighth book lays down the rules for the work of wasting, crushing and washing the ore. The ninth book explains the methods of smelting ores. The tenth book instructs those who are studious of the metallic arts in the work of separating silver from gold, and lead from gold and silver. The twelfth book gives us rules for manufacturing salt, soda, alum, vitriol, sulphur, bitumen and glass."

The author explains frankly that of course he has not fulfilled this enormous task, although he has done his best. He alludes to the large expense to which he was subjected, particularly in the matter of hiring illustrators to delineate the forms of "veins, tools, sluices, machines, and furnaces. . . . . lest descriptions which are conveyed by words should either not be understood by men of our times, or should cause difficulty to posterity, in the same way as to us difficulty is often caused by many names which the Ancients. . . . . have handed down to us without any explanation." This is characteristic of Agricola. His habit of mind was direct, searching, and honest. We shall see other illustrations of this as we proceed. He trusted only to the evidence of his own senses, or to the statements of persons on whom he knew he could rely.

Book I. is in effect a defense and eulogy of "the metal industries." It is replete with quotable passages. So rich is it that only with difficulty can choice be made. First, the author proves the essential dignity of mining. The miner must know something of "Philosophy" (geology), of medicine, of astronomy ("that he may know the divisions of the heavens and from them judge the direction of the veins"), of surveying; of "Arithmetical Science;" of architecture; of drawing; and, of the law, "that he may claim his own rights, . . that he may not take another man's property and so make trouble for himself, and that he may fulfil his obligations to others according to the law." In a word, Agricola defines the qualifications of a mining engineer and defines them well.

Mining, even in the year 1556, had its detractors. Because "scarcely one in a hundred who dig metals or other such things derive profit therefrom," and because others deceive themselves with ungrounded hopes superficial critics damn the whole industry. Agricola rises in protest. Even husbandmen choose carefully their soil and their crops. Care and attention minimize the risk of loss in mining, and are equally necessary. The ignorant and incompetent lose both time and trouble. The informed rarely lose either.

To prove the stability of mining, Agricola instances the gold and silver mines of Schemnitz and Cremnitz that had then been worked for 800 years; while the New Schonberg at Freiberg dated back beyond the memory of man. True, a miner might be disappointed in one vein, but he can always "dig another vein, if fortune does not amply respond to his prayers in the first case." And, though the business of mining may be less reliable than agriculture, is it not, asks he, infinitely more profitable? As for the risks to human life (and they must have been many in those far days!), accidents, asserts Agricola, happen "only in so far as workmen are careless." In like manner is every argument against mining disposed of. The classics are drawn upon profusely in praise of the metals. And to bring the discussion (which includes some really sage advice on mining shares) to an end, it is shown that "certainly, though it is but one of ten important and excellent methods of acquiring wealth in an honourable way, a careful and diligent man can attain this result in no easier way than by mining."

Book II. opens with "more ample information concerning the miners." In the first place "it is indispensable that they should worship God with reverence." It is God's decree, says Agricola, that those who know what they ought to do and how to do it properly, usually meet with good fortune, and *vice versa*. If a man owns a mine himself, he must visit it frequently, even work with his own hands. The diligent workmen are to be praised by the owner. His comings and goings should be announced so that the workmen may not be frightened by his unexpected presence.

With syndicates as with private individuals, the risks of investment should be considered carefully and some person or persons held responsible. And so on. Preliminary considerations such as roads, topography, fuel, timber, water, etc., are touched up, and the outward and visible signs of the existence of veins are outlined. "The forked twig," or divining rod, is given a page or two, and the summing up is one of the best things in the whole book. "A miner, since we think he ought to be a good and serious man, should not make use of an enchanted twig, because if he is prudent and skilled in the natural signs, he understands that a forked stick is of no use to him, for as I have said before, there are the natural indications of the veins which he can see for himself without the help of twigs." Could the whole matter be summed up more beautifully!

In Book III., Agricola discusses "veins and stringers, and the seams in the rocks." Roughly, the fissure vein was the "vena profunda;" the bedded deposit, the "vena dilatata;" the impregnation, the "vena cumulata;" and the stringer, the "fibra." The relation of rock structure to the veins is a matter of discussion. So also is the compass. The book concludes with a dissertation on veins and stringers as they actually occur.

(To be continued.)

THE CYANIDE PROCESS IN CANADA*

By HERBERT A. MEGRAW, New York.

Cyanidation is a comparatively new process in Canada. Until quite recently, in Eastern Canada at least, the gold and silver production was relatively small, and metals were in the main recovered as by-products from the reduction of base metals. In British Columbia, however, the cyanide process has been employed for some time past in the treatment of gold ores. The utilization of the process to any considerable extent in Eastern Canada was occasioned by the development of metallurgical practice in connection with the treatment of the silver ores of the Cobalt district. These ores, consisting as they do, of a chemical and mechanical mixture of silver with iron, sulphur, manganese, nickel, cobalt, arsenic, antimony and sometimes small quantities of mercury, present to the metallurgist an unattractive combination for cyanidation; in fact, their amenability to such treatment would not recommend itself to one at first glance. Naturally enough, the shipping of the rich ore to smelters and the concentration of the lower grades into a product rich enough to ship, were the first processes in use; but eventually experiments with cyanide solutions were made and now cyanidation is an established metallurgical means of recovering silver from the Cobalt ores. There is little doubt, however, that it has not yet by any means reached its apex of efficiency nor its widest application. In the early stages of application this condition is to be expected and, since the ores present a metallurgical problem which cyanidation in no other instance has been called upon to solve, it is extremely probable that some variations of methods will eventually be devised peculiarly adaptable to ores of this complex character and differing radically from usual practice. Until now methods in the Cobalt district have been largely those already in general use. An exception, however, is afforded in the case of practice at the Nipissing high-grade mill, now well known throughout the metalurgical world, where a peculiar combination of processes is employed and applied successfully in the treatment of extremely rich silver ores. But the method here can scarcely be described as cyanidation, for the greater part of the recovery is effected by the amalgamation. It is nevertheless, an example of the fitting of a process to the material to be treated and as such deserves special praise and study. Presumably the system in use at this mill is familiar to all interested in the subject, but a brief review of its principal features may be permissable.

The ore, the values in which are as high as 3,000 oz. silver per ton, is first crushed dry in a ball mill to a point where it will pass a 20-mesh screen. It is then sampled and stored until required for treatment. The first step in actual metallurgy is the charging of the crushed ore into a tube mill together with mercury, a 5% cyanide solution and pebbles for grinding. The tube mills thus converted into what is practically an amalgamating barrel, with the addition of the grinding feature, unusual in combination with amalgamating systems.

The whole charge thus made is sealed in the tube mill and the machine started. The revolution of this tube at usual speed naturally results in a rise of temperature, and it is possible that this rise might exceed the point of assisting amalgamation and become positively dangerous to successful results but for the fact that it is controlled to some degree by passage through the mill of compressed air, which readily absorbs part of the heat and removes it. It would be natural to expect a large loss of mercury in this procedure, due to "flouring" or "sickening," but it is stated that this does not occur, the loss is not great and is presumably offset to some degree by the small amount of mercury contained as mercury-silver amalgam in the ore.

The action within the tube is probably that of liberation of the metallic silver by the fine grinding and its immediate amalgamation with the mercury, which is maintained in an active state by the temperature and the strong cyanide solution. The latter keeps the mercury clean by dissolving those compounds which when present convert it to fine globules and prevent their coalescence, a condition in which it is known as "floured" or "sickened" mercury. It is undoubtedly true that the cyanide solution thus becomes charged with many elements which it carries into the subsequent treatment. This treatment consists of agitating the now finely ground ore, after the removal of the mercury and amalgam, in the usual way in tanks with cyanide solutions.

As these solutions are used repeatedly it is probable that there is some point where these foreign elements, or a portion of them are removed; otherwise accumulation would result to such a great extent that the solutions would lose their efficiency. The natural place to anticipate difficulty would be in the precipitation department. Zinc shavings are used for precipitation, and it is noticeable that during the passage of the solutions through the boxes a precipitate, light in weight, is formed which does not remain to any great extent in the box but passes through it and settles in the large, quiet area of the sump tank. Analysis of this precipitate has shown the presence of practically all of the elements mentioned as contained in the ore. This occurrence will account for the removal of many disturbing elements, and the fact that the pulp after leaving the tube is diluted with this precipitated solution makes the additional dissolution of silver in the tanks readily understood. In addition to the elements removed in this way from solution, it is altogether likely that some of the elements which are at first dissolved in the cyanide solution will be precipitated as sulphides, due to the large sulphur content of the ore. This will account, certainly, for the removal of some of the mercury dissolved, which will form an insoluble sulphide, and also explains the non-use of lead salts during cyanidation, as is usual in most silver treatment plants, the mercury efficiency taking its place.

The total recovery effected by this combination of processes is said to be about 99%, possibly more at times. The amalgamation is responsible for about 97%, the cyanide recovery being comparatively small, but nevertheless well worth while on account of the extremely high original content of the ore.

The whole scheme of treatment is ingenious and reflects great credit upon the metallurgists responsible for its devising, namely, Mr. Charles Butters, assisted by Mr. G. H. Clevenger and Mr. James Johnston.

Three other Cobalt mines are practicing cyanidation in some form and degree. These are the Buffalo Mines Co., the Dominion Reduction Co., and the O'Brien. The Buffalo uses both concentration and cyanidation, treating by cyanide only the slime formed during crushing and grinding, which is not more than about 20% of

*Read at Ottawa Meeting. C. M. I.

the total ore crushed. About 80% to 85% of the silver contained in this slime is reported to be extracted by cyanidation in the usual form, using air agitation tanks. Steam coils are employed in the tanks to assist solution of the silver, which is a necessary procedure during the cold season and may be of practical utility at other times. The Buffalo company is installing or has now installed an auxiliary plant for the treatment of rich products by a system similar to that in use at the Nipissing.

At the O'Brien mill concentration of the total ore is followed by cyanidation, the usual methods being followed, all the ore being reduced to a point where it can be agitated. At this mill an unusual feature is the precipitation, aluminium dust being used instead of zinc, otherwise the method is the same. The advantages are that one ounce of aluminium dust will precipitate three ounces of silver and that the resulting precipitate can be melted without the use of flux, producing a high grade bullion. As the cost of the aluminium dust is about three times that of zinc the advantage is apparently reduced to the ease and economy of melting, which may be important and which certainly deserves investigation, if it has not already received it.

At the mill of the Dominion Reduction Company a most careful system of concentration before cyanidation is followed.

At the new mill of the Nipissing Company, completed since the writer's visit to the district last autumn, the plant is designed to cyanide ores of lower grade, 25 to 30 oz., without preliminary concentration, other than jigging, making a total slime product, and to make use of some chemical innovations. Chemical improvement is of vital importance to the successful cyaniding of these ores.

In addition to the mills already using the cyanide process, the large number of concentrating plants in operation are producing a quantity of tailing of appreciable value which might be amenable to cyanide treatment in some form. This material being already crushed and in condition for economical handling should yield a further profit. Some chemical improvement by means of which cyanide losses could be reduced and extraction increased would be of immense value.

In this connection attention may be called to the increased extraction of silver at the Tonopah and other silver treating mills by heating the solutions to 120. Also the stress laid by some western metallurgists who are convinced of a notable improvement in extraction by crushing ores in water, removing the water so far as possible, and then applying the cyanide solution. It seems possible that a preliminary application of some solution might result in increased efficiency, and it is certainly worth while searching for a method that can be applied successfully to these ores. The Cobalt ores differ so much from those to which these measures have been applied that it is natural to expect a different procedure in treatment and there is room for further experimentation.

The situation as regards cyanidation is entirely different in the Porcupine district. Here the principal value is in gold which is contained in a quartzose ore, comparatively clean and presenting no metallurgical difficulties. The two mills at present using cyanidation on a large scale, the Dome and Hollinger, are accomplishing the same metallurgical result by two different mechanical means. At the Dome, plate amalgamation is employed to recover the free gold which is in particles too large for dissolution in cyanide solutions within a reasonable treatment time. At the Hollinger this material is recovered by concentration on tables, and subsequent treatment of the concentrate by pan amalgamation. At the Dome mill the ore is crushed in water in order to assure successful amalgamation; while at the Hollinger, crushing is in cyanide solution. It has been found at the Hollinger that very little gold escapes from the tube mills, but, due to its weight, is retained in the tube mill until ground fine enough to be dissolved. This will probably make some change in procedure advisable.

At the Dome mill the water crushing is objectionable on account of the fact that it necessitates the introduction of a large amount of water into the cyanidation cycle, and this must later be discharged with the residue and will then contain considerable cyanide with possibly some dissolved gold. The probabilities are that the amalgamation system is unnecessary viewed in the light of the experience of the Hollinger. Even if it is not, amalgamation may be successfully performed in cyanide solutions, as is done at the Liberty Bell mine at Telluride Colorado, with eminently satisfactory results.

In Canada, gravity stamps appear to be regarded as the only feasible crushing machine. The trend of the time, however, is towards discarding stamps on the grounds of expense and trouble of operation. The writer believes that, in general, other crushing systems are more economical and more satisfactory. Even in South Africa, where the heavy stamp finds its chief advocates, some metallurgists are earnestly recommending a change. Either rolls or Chilean mills, or a combination of both will be found, it is believed, to have advantages aver stamps. It is to be hoped that in the near future some experiments may be made that will determine finally this point.

CANADIAN MINING INSTITUTE—WESTERN BRANCH

The fourteenth general meeting of the Western Branch of the Canadian Mining Institute was opened at Nanaimo, Vancouver Island, B.C., on the afternoon of March 4. In the unavoidable absence of the chairman of the branch, Mr. M. E. Purcell, of Rossland, who was attending the annual meeting of the Institute in Ottawa, Mr. Thomas Graham, chief inspector of mines for British Columbia, presided.

After a few words from the chairman, Mr. Thos. R. Stockett, general manager for the Western Fuel Co., owning and operating three local coal mines, extended a welcome to the visitors. In the course of an interesting address, Mr. Stockett mentioned that Nanaimo is the oldest coal-mining centre on the Pacific Coast. Before the advent of white men, coal was mined by Indians; the earliest commercial coal mining here, however, was done by the Hudson Bay Co. While coal was found at Nanaimo in 1849, it was not first mined in a systematic way until 1852, but mining had been continued there ever since. As stated, the first operator was the Hudson Bay Co., which, a few years later, sold the Nanaimo mine to an English company, the Vancouver Coal Co., which was reorganized in 1899 as the New Vancouver Coal Co., while in 1902 the Western

Fuel Co. acquired the property. Coal was reached in No. 1 mine, known as the "grand old mine of British Columbia," in 1883, so that mine had been operated for 30 years. To-day there is as much coal in sight in that mine as has been taken out of it, so it is difficult to prophesy what its future will be. During the past month a record was made of 1,700 long tons in a single day's hoist, while the average daily output for the week had been 1654 tons. On a similar basis, working 300 days in the year, an annual output of half a million tons could be made, and it is thought the days for such a production are not far distant. The company is now opening a new mine, known as the Reserve Shaft, on an Indian reserve four-and-a-half miles from its shipping docks, where there is a splendid bed of coal at a depth of about 1,000 feet, which will shortly be reached by the shafts now being sunk. This mine is being equipped for an output of 2,000 tons of coal a day. Mr. Stockett mentioned, further, that the company takes a deep interest in everything tending to the safety of the men in its employ. Mine rescue oxygen breathing apparatus was provided by the company and men trained in its use before the Provincial law requiring this protection for the men was enacted. The local Mutual Improvement Association, established by the company's mine employees for the discussion of mining subjects, has been encouraged; also every assistance has been given to Mr. F. Napier Denison, of the Dominion Meteorological Office, to carry on investigations and make observations in the mine, in connection with his theory that there is relation between earthquakes and earth-movements and mine disasters. Information was also given showing the low death rate in the company's mines.

After the chairman had made reference to the assistance and co-operation given so readily by the United States Mine Rescue Training Station officials at Seattle, Washington, prior to the establishment of the local mine-rescue corps, an interesting and instructive paper was read by Mr. Geo. Watkin Evans, of Seattle, on the Groundhog coal field in the northern part of Skeena district, British Columbia, in which field Mr. Evans spent the summer of 1912 examining coal lands for clients. A series of lantern slides showed the rough topography of the country, and in some instances the nature of the rock formations.

A paper on "The Best Methods of Mining Coal Under Various Conditions," prepared by Mr. Alexander Sharp, of Vancouver, B.C., for the annual meeting, Ottawa, was, by the courtesy of the secretary of the Institute, presented. This was one of several Mr. Sharp had undertaken to prepare; it dealt largely with longwall mining, and in it were references to the conditions in parts of the Nanaimo field, Mr. Sharp having been manager of a local coal mine some years ago.

Tuesday Evening Session.

On Tuesday evening, the proceedings were opened by Mayor Shaw officially welcoming the Institute and its guests to Nanaimo, and then at some length reviewing the progress of the coal mining industry of the province, besides giving information concerning coal mines on Vancouver Island.

Mr. Henry Clark, M.I.Min., E., Canadian manager for Head, Wrightson & Co., of Stockton-on-Tees, England, colliery and mining engineers, next read a paper on "Modern Surface Equipment of Coal Mines," in which he gave a review of his work and experience in connection with the surface equipment of collieries in different parts of the world. He dealt with head-frames, pulleys, keys, cages, simultaneous banking, safety devices on cages, air-boxing for upcast shafts, safety detaching hooks, patent tipplers, mining cars, screens, picking belts, horizontal screens, coal-washing, storing and shipping coal, maintenance, etc. The address was illustrated by numerous landern slide views, some of them showing bankhead equipments as a whole, and other details of construction, etc. In addition several models were shown. The address was well received and many questions were asked and replied to at its close.

Wednesday's Proceedings.

On Wednesday morning a visit was paid to the new Reserve Shaft mine, under the guidance of Mr. T. R. Stockett, general manager; Mr. Thos. McGuckie, general superintendent, and Mr. A. S. Hamilton, master mechanic. Both of the new shafts are 10 x 26 feet in the clear, divided into three compartments—two for hoisting and one for air. Each has an area of about 100 square feet, and in this connection it was pointed out that it is unusual to have the air shaft as large as the main shaft. Hoisting engines, which were installed shortly after sinking was commenced and since used in this work, were made by Andrew Barclay & Sons, Ltd., Kilmarnock, Scotland; that for the main shaft is 30 x 60, with 14-foot drums, and that for the air shaft 20 x 54, with 12-foot drums. Both are provided with all the latest known devices for preventing overwinding, checking speed, and automatic closing off if the hoist engineer be neglectful or disabled. The Canadian Rand compressor is compound steam, compound air, 2,500 cubic feet capacity. Two h.r.t. boilers 84 in. x 16 ft., each with 104 4-inch tubes, generate steam; four more will be added to make the full battery. A double Sirocco 90-inch fan is being put in, capacity 400,000 to 500,000 cubic feet of air. The standard gauge railway from the mine to the company's shipping docks crosses the Nanaimo River near the mine on an overhead Howe truss bridge having two 150-ft. spans, with centre pier; this bridge has been built strictly in accordance with the requirements of the Railway Act of British Columbia. The total expenditure to date on railway, shaft-sinking, machinery, etc., has been approximately $500,000, and it is estimated that it will require a further outlay of fully $300,000 to place the mine in condition to regularly maintain the projected output of 2,000 tons of coal a day.

After lunch the party was taken in the company's launch to Malaspina's Gallery, a striking natural grotto or balcony cut out of the sandstone rock on the northwestern shore of Gabriola Island by the action of wind and wave, more than 100 feet long by about 10 feet wide. Capt. Alexandro Halaspina, an accomplished Italian navigator, in the service of Spain, is stated to have discovered this natural phenomenon when hereabouts in 1791, engaged on an expedition of survey and discovery. He went as far north as Malaspina Glacier in Alaska, between Mt. St. Elias and the sea, the glacier having been named after him.

Mine-Rescue and First-Aid Work.

On Wednesday evening Mr. J. F. Menzies, general superintendent for the Northwestern Improvement Co., of Roslyn, Washington, U.S.A., gave an address on mine-rescue and first-aid work, and he was followed by Mr. P. B. Ashbridge, St. John Ambulance Association instructor in first-aid work to the Canadian Pacific Railway employees west of Winnipeg. Mr. Matthew Gunness, of the local Mutual Improvement Association,

read a paper on "Mine Accidents and How to Prevent Them." Instructive discussion ensued on each of these subjects.

During the evening the chairman, Mr. Graham, who before he became chief inspector of mines was general superintendent for the Western Fuel Co., stated that the company has sixty-five "graduates" trained in the use of mine-rescue apparatus. In the Province of British Columbia there are now eighty-eight sets of oxygen breathing appartus—49 two-hour Draeger, 30 half-hour Draeger, and 9 Fluess. As there are 7,130 persons employed in the coal mines ,this gives one for every 81 persons employed. Fatal accidents in coal mines in British Columbia during the last three years had been: In 1912, 3.93 per 1,000; in 1911, 2.32 per 1,000; in 1910, 3.61 per 1,000. The lower ratio in 1911 was due to the fact that during about seven months of that year most of the coal mines of the Crow's Nest Pass were inoperative, owing to a strike of the miners, the quantity of coal produced that year from those mines having been 800,000 tons less than in 1912. For a 10-year period, 1903-1912, the death rate had been 5.078, atributable to—falls of roof, 6 (21.43 per cent.); falls of coal, 3 (10.72 per cent.); mine cars and haulage, 9 (32.14 per cent.), and 18 (64.32 per cent.); explosives 7 (25 per cent.) miscellaneous, 3 (10.78 per cent.). Seventy-five per cent. of the accidents—caused by falls of roof and coal land hauluage—were avoidable, and were due to negligence on the part of those directly affected, or to lack of discipline of officials. Mr. McGuckie gave particulars of the progress of mine-rescue training at Nanaimo.

Before adjournment, Mr. E. Jacobs, secretary of the branch, heartily thanked those who had taken part in the varied and interesting program, especially the visitors from the State of Washington, and, to Mr. Stockett and the other residents of Nanaimo who had cooperated to make the meeting the distinct success it certainly had been.

Adjournment was then made to another hall where Mr. Stockett had provided supper for between 100 and 150 present, and this was folowed by a smoking concert, the excellent program of which was carried out chiefly by employes of the Western Fuel Co.

MORE POETRY

[Note.—The following verses were written by Mr. A. S. Hamilton, master mechanic for the company, and read by him at a banquet of the officials of the Western Fuel Company, Nanaimo, Vancouver Island, British Columbia. While the occasion referred to was not in the immediate past, the sentiments expressed are live ones to-day, as they were when the writer of the verses first read them.]

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Response to the Toast—"The Surface Department."

In looking around me for something to say
In response to this toast;
I'm hoping to utter no language that may
Look to you like a boast;
For rather, I think, do we surface men feel,
That here on the Top we've the best of the deal;
We're content to be reckoned a spoke in the wheel,
A unit at most.

But just for a moment we ask for your ear,
Since we're in the act;
And would like to remind every mining man here,
With tenderest tact,
That though we don't share in the strenuous pace,
That exists down below in your hell of a place,
The troubles don't end when coal leaves the face;
And that is a fact.

According to what the geologists say,
It duly appears,
The coal has been formed and hidden away,
For millions of years;
And often we feel that their theory's right,
It so clearly explains why the coal it takes fright,
And balks just as soon as it hits the daylight,
And this valley of tears.

Now everyone knows just how fractious it gets,
And how eager to shine,
Though we handle it just like a child in the pets
All to hold it in line.
When we read of its energy, bottled and pent,
And its frantic ambition to find a clear vent,
We're ready to swear that the most of it's spent,
Right here at the mine.

How they manage at 'Frisco there's few of us know,
And less of us care,
For long before they have their troubles below,
We've had our share.
From the foot of the shaft to the ship at the dock,
'Tis nothing but one constant stubborn balk,
And it often exhausts all the patience in stock,
And would more if it dare.

Yet do not assume that as martyrs we pose;
We make no such appeal;
We're paid for our work, and as everyone knows,
That's all in the deal;
But to-night we make bold to present to your view,
A blue-jumpered, plain-looking chap in our crew,
To whom we feel certain your homage in due;
The man at the wheel.

He stands at his throttle from morning till night;
You ne'er saw him flinch;
And the swift plunging cages that're hid from his sight,
He'll land to an inch;
The big creaking drums that would like to run wild,
He handles them just as a woman her child,
And they know he's the boss; but though usually mild,
He can hurt in a pinch.

In the morning he tests every lever and screw,
Each cotter and pin;
And he makes them all swear they will stand by him
Through thick and through thin. [true,
The turbulent parts of his monster machine,
He pats on the back—though he lectures them keen,
While the big, sombre dial stands watching the scene
With satisfied grin.

By a curious blend of coincident law,
And mechanical rules,
His nerve is of steel and as free from a flaw
As the lever he pulls;
And you step on the cage with a confident air, [care;
And, without the least thought, place your life in his
You instinctively feel that you're safe while he's there,
At the end of the tools.

His mind is spring-loaded and ready to pop,
If the least thing goes wrong;
He'll spring like a trap should the signal to stop
Be flashed on his gong;
Yet, though he lives under this tension and strain,
And an air of excitement envelopes his plane,
The power of control, and command of his brain,
Looms up in him strong.

From the manager down we may all make mistakes,
Strange as it may seem;
Yet we may o'ertake them without any aches,
Or the loss of a dream;
But the man at the hoist must have never a trace,
Of an error, no matter how strenuous the pace;
And this truth alone should command him a place
High in our esteem.

We're obliged for your toast and 'tis pleasant to know
That we have your goodwill—
May the sentiment mutual continue to grow
While we grind at the mill;
And when in the future we socially meet,
And extend to each other those compliments neat,
We humbly request you to take from your store
Of greetings and wishes one little cup more;
An extra kind whisper of praise in the ear,
A bumper that's bigger and fuller of cheer,
The pleasantest smile you may have at command,
The kindliest, friendliest shake of the hand,
Your nicest "good day" and encouraging smile,
A clap on the back of your jolliest style;
And shower them, along with the thanks of your wives,
On the man who so faithfully handles your lives;
He's the King of the Surface Crew, Boss of the Kit,
He's the muscle and nerve, he's the man with the grit;
He's the Prince to whom each of us raises his cap,
That dungareed, blue-jumpered, plain-looking chap—
THE MAN AT THE WHEEL.

NOTES ON MINING AND TREATMENT OF GOLD ORES

By R. B. Lamb, Toronto, Ontario.
(Written for the Canadian Mining Journal.)

In this paper I shall attempt to discuss broadly mining methods and metallurgical processes employed for the extraction and treatment of gold ores during recent years, and to indicate some probable lines of progress in the immediate future.

I shall not, of course, undertake an exhaustive treatment of the subject, but shall touch only such as appear to me salient points illustrative of evolution.

Gold is wisely distributed in nature in small quantities. On account of the scarcity of the metal, its resistance to oxidation, and its attractive colour, the miner has always favoured its exploitation.

Owing to the small weight of gold in a ton of material and in some instances to the difficulty of separating the metal from the gangue, special care is required to mine and treat the ores of gold without undue losses of metal. Exact metallurgical methods have been demanded and these have induced the creation of a body of technical men, who have learned to manipulate with a high degree of scientific skill.

In gold recovery, we are not so much interested in the percentage of extraction, as in the value lost in the tailing. Percentages may be misleading; tailing-values never.

Throughout the ages mining for gold has been one of man's favourite occupations. As civilization advanced and man marched industrially onward the business of gold mining became more and still more defined, until now it has assumed all the dignity of a recognized commercial undertaking, directed by scientific thought and means. But mining for gold is now, or should be, only undertaken by those who are qualified. It cannot be too often repeated, that the only opinion worth following on a gold problem—either mining or treatment—is the opinion of one trained for that purpose, namely, a mining engineer.

Engineers may differ in attainments, in training and experience; nevertheless, advice by the trained official of the problems at hand is the only direction that money, time or thought should be risked upon.

We are now at a time in the history of gold mining when we must not deal with the fantastic ventures of the promoter as with the industry of gold mining. We must only consider real mining and ore reduction.

A large part of the world's gold supply has been recovered from placers and gravel deposits of various kinds in which gold is present in the metallic state, alloyed usually with a little silver. It occurs as gold dust or grains and nuggets of varying sizes, but rarely exceeding a few ounces in weight. Gold obtained by hydraulicking or dredging is much finer than that from other gravel mining and can be readily saved.

In earlier times and still within the memory of the living, gold from the shallow deposits was recovered by washing with hand appliances, sometimes with the aid of a horse or mule. The machines used were crude and simple—generally made on the claim.

The shallow placers of Australia and America, for instance, were a boon to the miner without capital and were quickly and inexpensively worked. High recoveries were made with the simple hand appliances readily fashioned on the ground. Thus, the easily worked shallow deposits quickly disappeared and gravels, which contain only a very small amount of fine gold, are left for subsequent working. Obviously, to render these profitable, machinery for the preparation of the deposits for removal on a large scale was necessary. Thus, we find shallow placers and rich gravels, which were, at one time, very profitable to hand methods, are now exploited by hydraulicking and dredging.

Another type of workings, called in Australia "deep leads" and in California "drift mining" (generally an old river channel covered by rock formation) demanded special mining. When the gravel taken from these deposits has been brought to the surface, the separation of the gold from the matrix is as simple as with shallow placer mining.

Much of interest might be said and written on placers and deep leads and other gravel deposits carrying gold; but as the methods employed are comparatively simple and well understood, and as these deposits in the future will probably be much less important than at present,

and still less important than lode mining, we will pass on to gold obtained from ores in vein mining.

Gravel mining, which is probably the simplest of mining, has called to its aid electricity and mechanical appliances used in hydraulicking and dredging. Gravels with a low-grade gold tenor offer to-day principally problems of moving material. Their exploitation is an engineering problem either of conveyance of material in large quantities by mechanical means, or by the agency of water. From whatever view point we look at gravel work, except deep lead mining, the question calls for an engineer to work out the following problems: To prepare the deposit for removal and remove it; to wash it to recover the gold; and to dispose of the tailing. The actual extraction of the gold from the gravel matrix is a matter so simple as to call for no special comment. In all rich placers and gravels, Nature has really mined the ore and placed it in defined channels or beds, concentrating the gold during deposition and rendering its removal and recovery easy and inexpensive. When the rich shallow gravels are worked out, the opportunity of the ordinary working miner to make gold mining a profitable business disappears, and the skill of the trained operator is required.

The production of gold from vein mining, on the other hand, has been steadily increasing during the past ten years and for the year 1912 we have the largest production from vein mining on record. This has been due to several causes. A large factor is the discovery and intensive exploitation of the deposits of the Transvaal. The real cause, however, appears to me to be that many deposits are of such nature that in order to return an adequate profit on the capital invested, operation on a large scale is compulsory. We have before us the evidence of a number of years of gold mining, showing that the early vein discoveries of importance were comparatively rich in gold and of limited tonnage. These were easily worked with small plant and little capital was required to return big profits on the investment. As the rich veins which were easily found (such as those of Australia and California) became worked out, larger deposits of lower gold tenor were developed and brought to the producing stage; hence, large combinations of capital involving greater development ahead of reduction processes became the practice. The development of a gold prospect, where a small amount of capital will put it on a producing and profitable basis and where the mine can be further exploited and tonnage and production increased out of profits, is a rare occurrence now. More comprehensive study and greater development with a view to blocking out tonnage ahead of a proposed reduction plant are essential factors in present day gold mining. It is becoming increasingly more difficult to mine in a small way. Capital is not attracted by small tonnage.

In the early days of California and Australia the type of ore deposit known as "free milling" best illustrates the simpler kind of vein mining for gold. In both these countries we have quartz veins carrying free and visible gold together with a small percentage of sulphides with which gold is associated. The outcrops of many of these veins were very rich and the gold readily obtained by free milling practice. The ease with which the gold was recovered and the handsome profits from operation rendered the early industry full of fascination and romance. It also retarded progress in the development of mining methods and metallurgical processes. Perhaps if we consider mining methods adopted in the gold fields of Victoria as an illustration, we will be better able to compare methods then used (and to some extent still used) with more modern methods, for instance in the west of Australia and in Mexico.

In Eastern Australia, particularly in the gold fields of Ballarat and Bendigo, when opening up a new prospect, sufficient ore is developed to justify the erection, we will suppose, of a five or ten-stamp mill and to keep it employed for about a year. If the prospect subsequently developed further ore, the mine would build itself up out of profits from this small beginning. If the property failed to develop more ore, another idle plant gave testimony to indifferent methods and shareholders were not compensated for the risk they had taken. These methods are still in vogue in the State of Victoria, although some of the more experienced operators are now convinced that it is better to develop the mine, and, as far as possible, determine what the probable life will be before building a reduction works. Old methods of stoping and handling ore underground still prevail in most of the mines. While the work accomplished is well done and the mines are worked with due regard to the safety of the workmen, they still lack the progressive spirit calling for the installation of improved equipment. Most of the mills at Ballarat were, seven or eight years ago and some are still, fed by hand. I remember when the first automatic feeder was put in a stamp mill in the Ballarat gold field. This serves to illustrate the backwardness, in some respects, of the early historical mining camps. Western Australia employed automatic feeders before many important camps in Eastern Australia would tolerate them. The splendidly trained miner of Eastern Australia in performance was ahead of his somewhat less skilled brother of Western Australia. To make up for the difference in men, machinery was generally utilized in Western Australia. This is well illustrated by machine drilling. While Eastern Australia is now employing air compression and rock drills for both development and stoping, a considerable time elapsed after the successful introduction of these methods in other parts.

The old time manager of the camp at Ballarat had a distinct prejudice against rock drills, without proper means of determining the cost between hand and machine work. He insisted that machine work was costlier than hand work. In a way, the eastern miner was right. If machine work had been introduced into eastern mines without compensating progressive introductions in other parts of the work, machine drilling would have been costlier to the eastern industry; but machine drilling once established, with all other parts of the mine working in harmony, as since adopted, has unquestionably proved more profitable to the mine owner in both eastern and western camps. Eastern Australia approved of the methods of the old practical miner and his management was the dominant factor in the operation of the mines of the principal gold fields of the country. It has not even yet escaped from the older methods. The technical man has not had a free opportunity in Eastern Australian gold camps and as a result, reliable cost data are not frequently dealt with. On the other hand, Western Australia and parts of Northeastern Australia have come under the influence of investors demanding direction by experienced engineers so that newer and better methods prevail, especially in the transportation of ore and delivery of ore from stopes and other mine workings.

Work under the old methods of Eastern Australia as stated before, is on the whole well done, and very cheap work in many places is accomplished; but through lack

of the guidance of the trained engineer, this work is done on propositions that frequently do not warrant the expenditure of such energy. Yet Western Australia is fruitful in instances of the advancement of gold mining methods, particularly the application of mechanical agencies to the treatment of gold ores.

The writer was in Kalgoorlie during the period of its most interesting development and took part in the metallurgical work of the time, as well as having the opportunity to study the work of other engineers in the same field. I remember the early worries of the Kalgoorlie metallurgist when tube milling and filter pressing were first introduced. Despite all the first troubles of slime settlement, classification, etc., this was probably the greatest school of metallurgy we have ever had for gold.

Mechanical progress kept pace with chemical methods, nor were underground operations lost sight of. Kalgoorlie alone was responsible for the early success and the adaptation of filter-pressing and tube milling to the treatment of gold ores, and, as far as I know, this camp was the first to dispose of the tailings from filter pressing for stope filling. The disposal of this residue was accomplished by mechanical means with the aid of belt conveyers and was a distinct step in advancement over old methods. The utilization of tilting furnaces in bullion refining was another step in the progress of the metallurgy of this camp.

The refractory sulpho-telluride ore of this region were high-grade, and suitable smelting facilities did not exist. The mine operator was faced with a situation, underground and above ground, of this nature. Underground, owing to the friable nature of the valuable mineral in the ore, careful mining was necessary. The magnitude of the ore bodies rendered extensive mining desirable and the lack of a convenient smeltery rendered treatment on the ground imperative. Kalgoorlie, therefore, was a distinct factor in the advancement of Australian mining methods and metallurgical processes. It was the pioneer in the treatment of refractory gold and of gold-silver ores. The mining world owes an immense debt of gratitude to Kalgoorlie. The high price of labour and the difficulties of desert operation rendered the mechanical handling of ore and tailings absolutely necessary, and the scarcity and poor quality of water emphasized the necessity of improving slime settlement, they pointed the way and made it possible for brilliant investigators in the United States and Mexico to reach the present state of high efficiency.

The Rand, on account of the depth and extent of its ore deposits, taught the mining world much in the way of handling ore and developing and blocking out ore reserves far in advance of milling operations. While attending to this problem the Transvaal rested content with the metallurgy of gold as worked out by earlier practitioners, and it was not until Kalgoorlie had demonstrated the value of more progressive methods that the Rand began to adopt these measures.

The gold tenor of the quartz veins of Eastern Australia is now generally so low that further improvement can hardly be expected until operators will introduce more progressive underground methods. Stoping systems that will eliminate to a much greater extent the shovelling of ore than is in use to-day and more up-to-date methods for handling ore underground will have to be employed before further cost reduction can be expected. The principal reason for marking time is the high quality of underground labour and the comparatively low price of this labour. This held back the introduction of special machinery, and the employment of technical men who would, in many instances, have adopted different mining methods than have been employed.

California, on the other hand, probably due to the love of Americans for mechanical devices and the close contact with other mining regions of America, adopted mining schemes that were a mixture of the older ideas and of newer progressive methods. In parts of California, splendidly equipped and well managed mines with good methods are found, and at other properties, we find deplorable methods and bad operation.

It is noteworthy that both the State of Victoria and the State of California were responsible for the development in the chlorination process. This process was evolved for the treatment of sulphides obtained from concentration of the quartz ore found in these regions. Australia (particularly the camp of Ballarat) in the development of the chlorination industry gave to the world the splendid Edwards roaster, which is now used throughout the mining regions. The chlorination process was the first chemical process to give decided satisfaction to the operator. It has since been supplanted by the cyanidation process—not because the cyanidation process is more thorough in its chemical work, but because the cyanide process is easily to operate and cheaper in cost. While we may not have much use for the chlorination process in the future, no words can express the value of the process to metallurgy as pointing the way to exact chemical manipulation for gold ores.

It is important to point to the fact that the State of Colorado has some examples of both the worst and best practices in gold mining. Probably no other state in the American Union has offered to the world a greater variety of ingenious appliances for use in gold mining and metallurgy than Colorado, and it is a matter difficult to explain why this state has supplied methods and machines for a country like Mexico right up-to-the-minute in progress, and suffers operations within her own borders, which are both crude and unscientific.

The dawn of modern methods began in Australia with the treatment of the immense heaps of tailing accumulated from the mills of the fifties, sixties and seventies. Eastern Australia with its tailing heaps developed the chemical side of metallurgy and Western Australia with its desert difficulties developed the mechancial side of metallurgy. The result was a highly efficient body of trained men. These men were available for other service as soon as the great tailing heaps had disappeared. Most of these accumulated tailings of Eastern Australia carried a considerable portion of sulphides which were oxidized by exposure to the air and complicated chemical salts resulted from weathering. To obtain the solution of the gold by cyanide before its destruction by the salts of iron and to do this at a low cost, sharpened the minds of those in charge and was responsible for an evolution that those engaged in the work look back upon with the fondest recollections.

The writer was one of the first engineers in the State of Victoria engaged in cyanidation and it is interesting to recall the fact that as our literature was meagre and opportunities for studying practice almost nil, operations, particularly those of refining, were largely a matter of conjecture.

We attempted to roast zinc-gold slime in diminutive iron trays in F Battersea muffles, and we tried to treat the slime with acid in a ten-gallon hogshead. Needless to say, our early attempts were terrible failures. Pre-

cipitation by charcoal was invented and utilized on most of the accumulated tailings plants in the State of Victoria. The reason of this was the large amount of caustic soda that was necessary to neutralize acid salts. The charcoal method of precipitation worked extremely well and was a very efficient method of gold precipitation for the special conditions in that State. The accumulated tailings were a mixture of sand and slime (usually a large percentage of slime). I think that it was in Victoria that the shallow vat of great diameter was first introduced and I believe I am right in stating that the plant erected at the Black Hills mine near Ballarat had the shallowest and greatest diameter vats of the time. The depth of sand was four feet and the diameter of the vat, if I remember correctly, was forty feet. The solution was applied from either two or four points at the circumference of the tank and flooding rapidly effected. Excellent extractions were made with these plants and the resulting profits gave adequate return on the investment. Many difficulties were experienced, as I have indicated, at the start. The principal troubles were due to the acid salts of iron causing a high cyanide consumption and the difficulty of percolation through the high percentage of slime. The initial high consumption of cyanide rapidly fell to small amounts and there are nstances of practice in Australia where a consumption of only four ounces of potassium cyanide per ton treated is recorded. Even at this late date, no better examples of extractions are given than some of those made on the accumulated tailing piles in the State of Victoria.

I wish to refer again to mining methods further to illustrate the effect on treatment in the State of Victoria and other places. I know of no better illustration for this purpose than mining on the Eastern Australian quartz veins. The conditions that prevailed there, namely, the high efficiency of the mine labour and the length of time before more modern machine methods were introduced in underground work had profound effect on the actual ore treatment. The manager watched stoping operations closely and the ore was always broken clean, as little as possible of unprofitable vein matter or wall rock being broken or mixed with the ore. Generally the ore was broken and cleaned out of the stope and then filling put in and stoping again continued; the ore going to the mill was handled carefully at all points on the way. The actual breaking of the ore was carefully regulated by frequent pannings from the faces; little or no assaying was done. As a rule, the manager was successful in delivering to his mill a very clean ore of fair gold tenor and the free milling nature of the ore resulted in high development of stamp battery amalgamation. I know of no place where so much efficiency is obtained from amalgamation behind a stamp battery as in the State of Victoria. The tonnage milled was also reasonably high. Having an ore readily amenable to amalgamation and much care being given in mining and amalgamation to this ore, we find that of all the ore mined in the State of Victoria the greater bulk of it made such a low-grade tailing that it proved unprofitable to re-treat it by any process. To-day the immense accumulated tailings of Ballarat and Bendigo stand as lasting testimony to the efficacy of the treatment throughout. The principal aim of the miner there was to extract as much as possible of the metal from his ore and not to regard tonnage as so vitally important.

Since air compression, machine drilling and, improved stoping methods were introduced, the same care in breaking ore has not been given. Indeed, it is not possible to break ore as clean by machine as it is by hand. On the contrary, methods of milling and of crushing and subsequent for metal extraction have advanced and progressed in such a way (so to speak) as to counterbalance the dilution of ore by hastier stoping. "Dirty" ore is to-day largely counterbalanced by the rapid and cheap ways we have for conveying and moving ore in the mine, around the mine, and through the mill. Modern mills are more concerned with handling tonnage cheaply. The old mill was erected to dress well. The new mill is designed to work quickly. We are now enabled, by chemical and mechanical progress, to dress both quickly and well. It is, therefore, really the progress in modern ore treatment that has made it possible to mine quickly and cheaply, simply because we are able to extract the metals cheaply and well, and dilution of grade between limits becomes less vital than formerly. The best example that can be given in proof of this is to take the records of progress of the camp of Kalgoorlie and the camp of Cripple Creek, Colorado, where refractory telluride bearing ores are being handled at a remarkably low cost with splendid results. Moreover, this progress is not stationary, but each year shows a great advancement on the methods of the year prior. Kalgoorlie is now treating profitably ore that has a gold tenor of only $6.00 to $7.00 per ton. Another splendid example of practice is Mexico. Mexico is awakening—not because new mines are being found, but because the mines of a decade ago were worked to the point where hand methods were no longer profitable. Side by side in Mexico, we have mines, some of which savour of antiquity and other which are examples of the most progressive methods in gold or gold-silver mining in the world of to-day. Mexican mining has been vitalized by electricity, belt conveyance of ore, Kalgoorlie methods of treatment and American methods of mining.

It is only during the last ten or fifteen years that mining engineers as a body have become cosmopolitan, moving actively around the world, exchanging ideas, adopting and varying the practice of different countries for different situations. We must realize that on mining section usually develops one thing well and to get the best of everything we must adopt ideas from the different practices of different countries. I think this development is best shown in the gold mines of South Africa and the gold-silver mines of Mexico.

A note of warning should be sounded here. We can be too progressive without experience. Engineers will adopt or try to adopt the newest practice for a budding proposition, not having experience or familiarity with all branches of that practice. The result is frequently a costly experiment. Time and money will rectify the blunders of this unbaked maturity. Meanwhile, some of the mine's ore reserves are wasted.

A relation between mining and metallurgy that is becoming more appreciated is the proper mixture of the ore prior to treatment. I remember a mine, twelve years ago, at which stamp milling was followed by amalgamation, and subsequent treatment of the sand and slime by cyanidation was practiced. The ore was quartz carrying gold and a small percentages of iron pyrites. In the ore shoot (pitching at a low angle through the vein) was a streak higher in sulphides than the remainder of the body. This streak carried a little bismuth as carbonate. In the early operation of the mine little attention was paid to this streak and the ore was sent to the mill without regard to it. On some days ore carrying a comparatively large percentage of bismuth was milled, and then probably for several days no bismuth would be encountered. The result of this practice was that the bismuth, being a mineral of high specific gravity, clung to the plates, affected the amalgamation, and bothered the

cyanide treatment. By properly mixing the ore, however, and keeping the amount from the sulphite streak as regular as possible, the mill men knew exactly the conditions confronting them and extractions were much improved.

An important feature of the relation between mining and milling is that of ore reserves to the capacity of the reduction plant. More failures are made in gold mining through too much and too early construction than from any other cause. It is necessary, for proper mining, that the construction-metallurgist should be in a position to check and verify ore reserves before plant design and erection. This factor controls the size of the plant for the developed ore.

However, a more important relation between mining and milling is that of life-expectancy. It is here that the highest skill of the engineers and managers is called into play. Most operators to-day, and all engineers, realize that to establish ore reserves and have a knowledge of future possibilities is of the very highest importance before designing and erecting a treatment plant. In many places and in a large number of important mines there is an interfering influence between mining and milling observable. I refer to the independent departmental management of a number of properties. It is highly important to have defined and properly correlated departments, each working systematically under the direction of a competent manager or engineer, but it is the height of absurdity to make such departments self-operative. Examples of this practice could be multiplied. Its effect can be more concisely realized by pointing to a few interfering factors.

We will suppose that we are dealing with a refractory ore which calls for cyanide treatment for the recovery of values, and we will suppose that there are interfering minerals, as for instance, maganese, bismuth, iron and copper salts irregularly distributed through the orebody. The metallurgist knows perfectly well that by proper selection of his ore he can cause beneficent reactions to take place during the treatment which will assist and render his operation more satisfactory and less costly. If such a mine were being operated on the departmental plan, the underground manager would have little regard for the work of the metallurgist but would conduct his operations to show to the best advantage for himself. The metallurgical end of the venture would probably prove costly, extractions would no doubt be low and irregular. Again should concentration be one stage in the treatment that is adopted, with the sensitive machinery now employed more labour would be required to control and regulate the machine due to the variation of mineral content. This would result in higher costs, lower extractions or both. Should mechanical difficulties to experienced in the mill and the underground department desire to show a greater tonnage and low cost, the mill would be handling more ore than should be properly treated and the metallurgical end would again appear at a disadvantage. It is needless to illustrate this further. The idea is apparent. We realize today that the best results can only be achieved on large propositions by departmental management working in perfect harmony through an executive engineering head. After all, this is the chief function of a high-class manager.

I cannot do better than conclude this brief review by giving the substance of what I had written two years ago. Metallurgy may be defined as the art of extracting metals from their ores and preparing them for the use of the manufacturer. It will, therefore, be understood that there is no plant or part of the equipment upon the surface of a mine that is not directly or indirectly connected with ore reduction. It should be understood that the surface equipment cannot be divorced from the mine equipment, and, therefore, the cost relationship between mining and metallurgy is the most important relationship of all because it is upon proper methods of cost keeping and distribution of charges that we are enabled to affect improvement and guide the operations of the mine. It will be recognized that it is impossible, in many cases, to separate absolutely the costs in one department from their bearing on the costs of some other department. Again, there is a close relationship between mining and metallurgy on the operating record sheets that are used to direct and control different departments. While we can benefit by the experiments of other countries, we can only use them as a basis of our own work

If an individual undertook the manufacture of shoes it is hardly likely that he would begin the process until he had obtained competent workmen. Why, therefore, should those incompetent to mine and treat ores undertake the extraction and reduction of these metals? It is clearly a matter for experts. Imitation has never fully solved any problem and never will. We must largely replace imitation in our practice and business methods by experience, and only take what, in the judgment of men trained in the business of mining, is thought to be suitable for the problem in hand. It must be realized, that every mine, no matter where situated, has its local conditions and local requirements and it is only by skill that these requirements can be successfully met. Every mine and metallurgical problem is distinct and depends upon the individual ore and on the particular chemical and physical characteristics of this ore. While the general design and mode of operations of any reduction works may be to all appearances similar to the mill adjoining, the operating metallurgist will have to use his brains to meet local requirements in his daily manipulation inside of the mill.

We have arrived at a state of mine equipment that would astound the forty-niner and we are triumphantly marching to a metallurgical goal that a few years ago was not contemplated. We are evolving the continuous treatment process, and few yet realize what this means for the future. An ideal process would be one which could treat ore without men and without supplies. We have not eliminated all the men yet, but they have been reduced over 50 per cent. in the past ten years. The consumption of supplies also has correspondingly diminished. There is no doubt that the matallurgical chemist will succeed in further reducing the present consumption of material.

In this brief review it is impossible to allude specifically to the splendid work that has been done in the various modifications of the cyanide process, and to enumerate and describe the different appliances that have been brought together to affect this evolution. It is unnecessary to describe the mining systems in use throughout the world for the extraction of gold ores, but the time is not far distant when we will have done with the stamp mill and all machines depending on the close application of an individual for their successful operation. We will simplify mills as we have simplified and improved underground systems. We will treat ore more cheaply than now, with fewer wheels and with less complication. Only recently we have witnessed the application of machinery to underground systems, the improvement of stoping methods, and the elimination of much physical drudgery. The wet treatment of refractory ores has been successfully accomplished. We are now facing simplification of plant design.

THE OCCURRENCE OF PYRITES IN CANADA

Notes from the Report* of Dr. Alfred W. G. Wilson.

PYRITES IN THE MARITIME PROVINCES.

Provincial reports and the reports of the Geological Survey of Canada contain many references to occurrences of the mineral pyrites in various localities in the provinces of Nova Scotia and New Brunswick. The writer has not been able to find any record of the mining of pyrites on a commercial scale at any locality in either of these provinces. In a few instances sample shipments have been made, but these were made many years ago, and the ore was valued for its copper content only.

The pyrites occurrences in the province of Nova Scotia, so far as the writer is aware, are not known to be large enough to be of commercial importance.

In the Province of New Brunswick, in the parishes of St. Stephen and St. David there are a number of localities in which both pyrites and pyrrhotite occur. No detailed description of these deposits appear to be available. Dr. Matthew, reporting on the district in 1876, states that they may be of commercial importance in the future. A verbal communication to the writer by a resident of St. Stephen confirmed this view. Exploratory work is needed to determine if any of those deposits are of commercial importance.

When visiting some supposed occurrences of copper ores in New Brunswick, the writer was informed that a large deposit of pyrites was known to occur on the northwest Mirmichi river above Red Bank. Direct inquiries of the alleged owners have elicited the information that no such occurrence is known to them.

In conclusion, it may be said that geologically one would expect that pyrites deposits would occur in certain localities in these provinces, since the conditions are very similar to those which prevail in Newfoundland and in several of the States to the south and west where these ores are mined. Much of the country is very difficult to prospect on account of the cover of loose waste, and so little is known of the country that it should not be said that such deposits do not occur. The most that can be said is that at present no deposits have been discovered and sufficiently exploited to show that pyrites ore can be obtained on a commercial scale.

PYRITES IN QUEBEC.

The pyrites deposits of the province of Quebec have been, until recently, the most important known to occur in Canada. Many of the ore bodies which have been mined for pyrites were discovered during the decade 1860-1870. The first claims were located as gold prospects: subsequently development showed that the ore contained an important amount of copper, and the claims were therefore operated as copper properties. A little later it was found that the high sulphur content of these ores rendered them valuable for acid making. The total output of the province during the last thirty-five years has probably exceeded one million tons of ore carrying 40 per cent. of sulphur or more.†

At the present time there are only two properties in active operation. These are the Eustis, formerly the Crown mine, located about 7 miles south of Sherbrooke, and the McDonald mine located about 7 miles from Weedon station on the Quebec Central Railway. The property adjacent to the Eustis mine, the Capelton mines of the Nichols Chemical Company, was operated between the years 1863-1908. In addition, a considerable amount of pyrites was mined at the Howard mine, formerly the Cillis, and at Moulton Hill northeast of Sherbrooke. Important deposits of pyrites are known to occur at the King mine, adjacent to the Howard, and on a property near lake Coulombre north of Garthby station on the Quebec Central Railway. Brief descriptions of these properties are given in subsequent paragraphs.

The occurrence of copper sulphides and of pyrite has been reported from a number of other localities in the province of Quebec. Where exploratory work has been undertaken it has almost invariably been for the purpose of discovering copper or gold ores. Occurrences of this type are particularly numerous in the belt of altered igneous rocks which runs in a southwesterly direction past the city of Sherbrooke. The district for about ten miles northeast of Sherbrooke and for about the same distance towards the southwest is worthy of very careful exploration, especially in the neighborhood of some of the old prospect openings. As the available information with respect to these prospects relates rather to their possibilities as sources of copper ore, detailed descriptions are reserved for the report on the Copper Resources of Canada.

Copper bearing pyrites minerals occur on almost every lot of the eighth and ninth ranges of the township of Ascot, south of Sherbrooke. A number of prospects also occur on the eleventh range and there are scattered prospects on other ranges.

Eustis mine.—This property is located on lots 2 and 3, Concession IX, township of Ascot, about seven miles south of the city of Sherbrooke. It is owned and operated by the Eustis Mining Co.‡

The discovery, which was made about 1865, was located on lot 4 of the ninth range. The ore body was followed down from the outcrop, and the main mass of ore was found to occur on the lot to the south. The ore body consisted of a series of sulphide lenses, dipping approximately at an angle of 35 deg. towards the southeast. The bottom of the present shaft is about 3,200 feet below the old sills. The largest of the lenses was nearly 800 ft. in length along the dip; the horizontal width, parallel to the strike of the rock structures, varies to about 250 feet, while the thickness varies from a few inches to over 70 feet at the widest points. The other lenses were of the same general shape, though somewhat smaller.

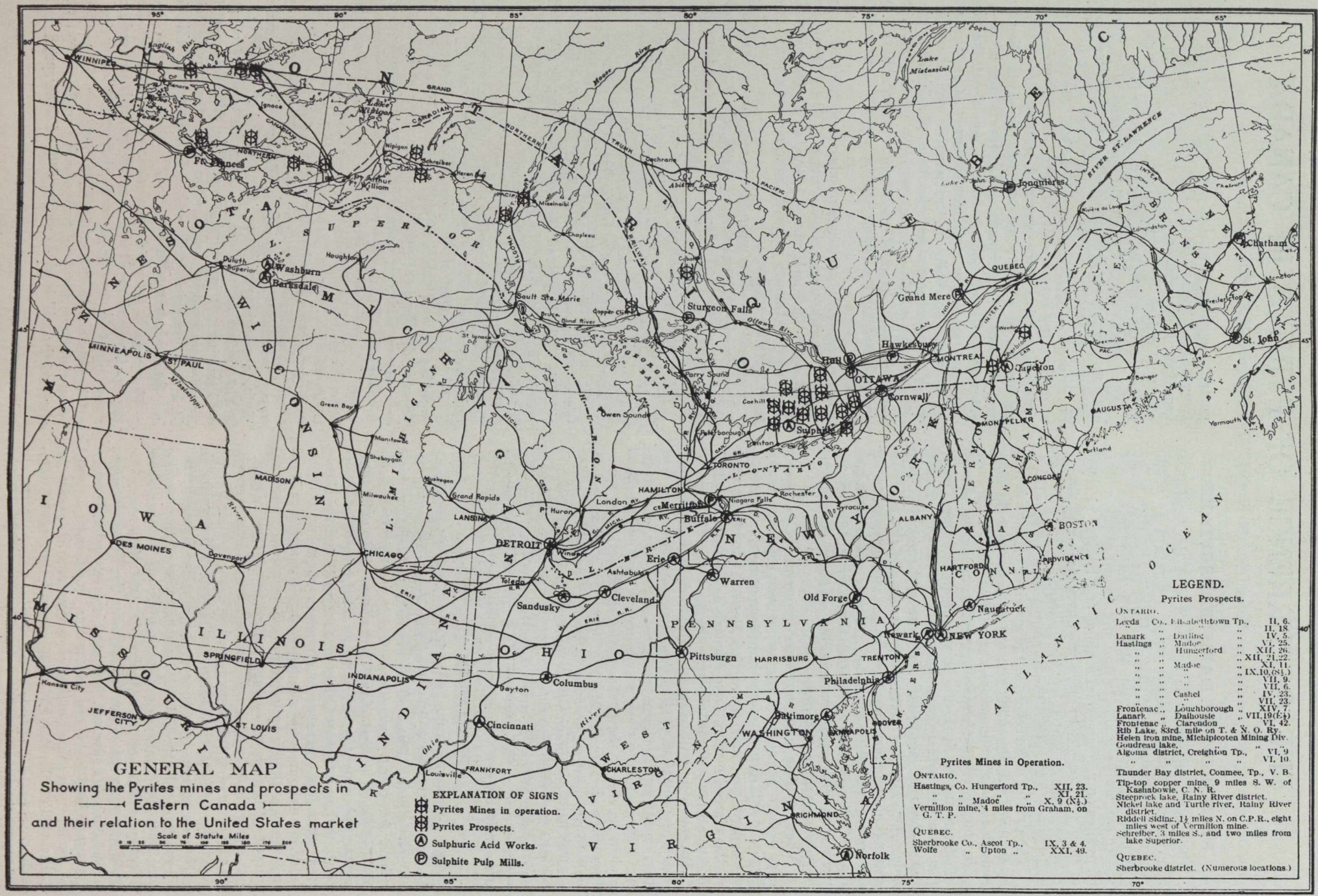
The total output of the mine, since it was opened, has probably been in excess of half a million tons of ore. At present, development work is well in advance of mining and there is said to be more than two years' supply ready for stoping. The ore is a particularly pure pyrites with which is associated chalcopyrite. The shipping ore contains 40-45 per cent. sulphur, some of the lump ore occasionally running as high as 50 per cent. sulphur. It usually contains less than 2 per cent. of copper, and very small values in gold and in silver. The ore from the upper portion of the mine is said to have contained a higher percentage of copper.

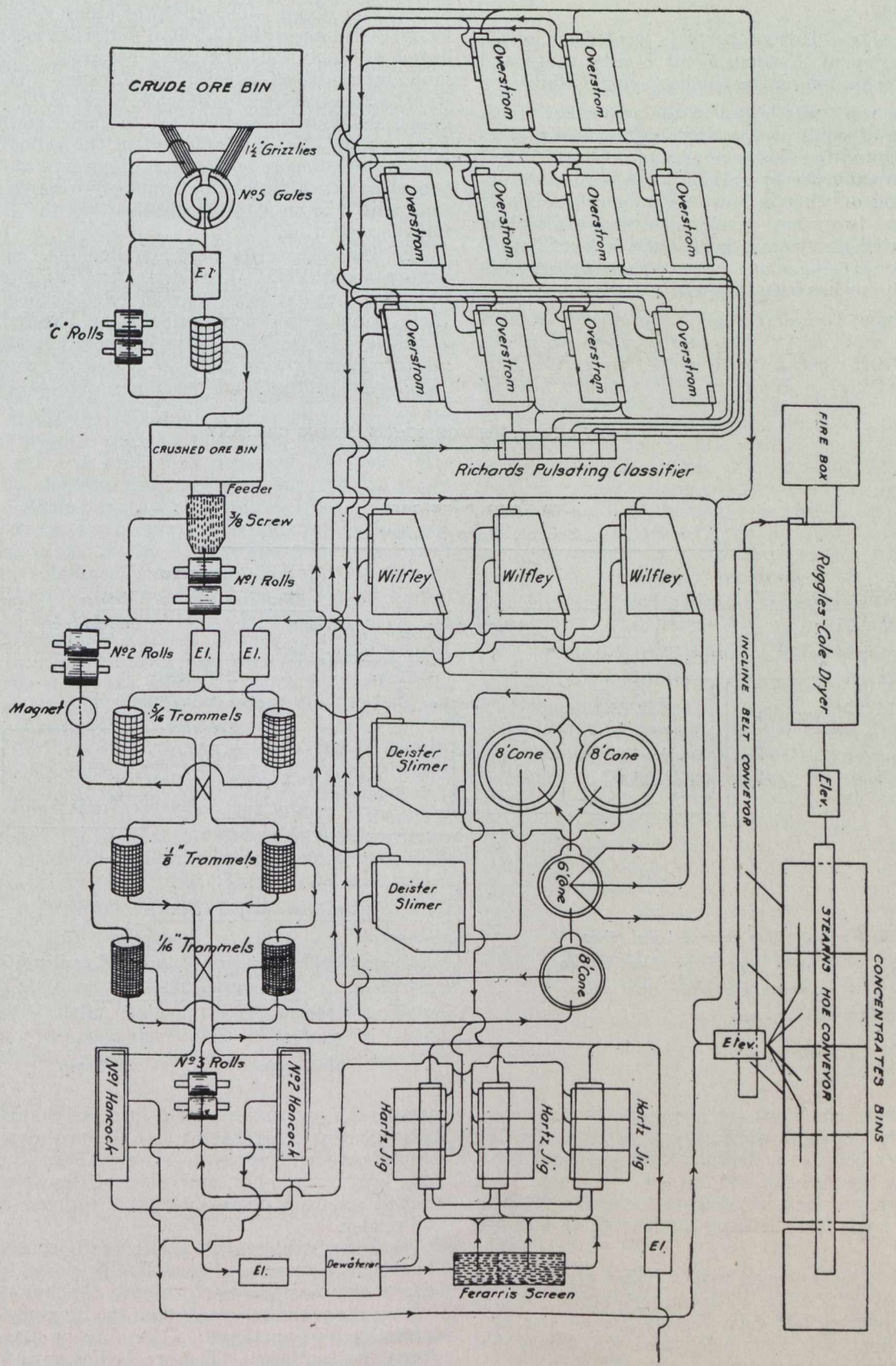
The ore is free from arsenic and is an excellent ore for acid making. It is said that ore from this mine was the first pyrites used in America for making sulphuric acid. It is also probable that it will be found very suitable for sulphite pulp manufacture.

The mine is operated by electric power generated on the Coaticook river. It is also provided with an auxiliary steam plant to operate the mill at times of low water.

There is a dressing mill on the property equipped to treat about one hundred tons of ore per day. The flow sheet of the mill is given on page 36 of this report.

*Dressing and Uses.—By Dr. A. W. G. Wilson, Mines Branch, Ottawa.
†No accurate statistics are available.
‡Head Office Brsoton, Mass., P.O. Box 1422.


GENERAL MAP
Showing the Pyrites mines and prospects in
Eastern Canada
and their relation to the United States market
Scale of Statute Miles
EXPLANATION OF SIGNS
Pyrites Mines in operation.
Pyrites Prospects.
Sulphuric Acid Works.
Sulphite Pulp Mills.
Pyrites Mines in Operation.
ONTARIO.
Hastings, Co. Hungerford Tp., XII, 23.
" " Madoc " " XI, 21.
" " " " X, 9 (N½.)
Vermillion mine, 4 miles from Graham, on G. T. P.
QUEBEC.
Sherbrooke Co., Ascot Tp., IX, 3 & 4.
Wolfe " Upton " XXI, 49.
LEGEND.
Pyrites Prospects.
ONTARIO.
Leeds Co., Elizabethtown Tp., II, 6.
" " " II, 18
Lanark " Darling " IV, 5.
Hastings " Madoc " VI, 25.
" " Hungerford " XII, 26.
" " " " XII, 21, 22.
" " Madoc " XI, 11.
" " " " IX, 10, (S½.)
" " " " VII, 9.
" " " " VII, 6.
" " Cashel " IV, 23.
" " " " VII, 23.
Frontenac " Loughborough " XIV, 7
Lanark " Dalhousie " VII, 19 (E½)
Frontenac " Clarendon " VI, 42.
Rib Lake, 83rd. mile on T. & N. O. Ry.
Helen iron mine, Michipicoten Mining Div.
Goudreau lake, " "
Algoma district, Creighton Tp., " VI, 9
" " " " VI, 10.
Thunder Bay district, Conmee, Tp., V. B.
Tip-top copper mine, 9 miles S. W. of Kashabowie, C. N. R.
Steeprock lake, Rainy River district.
Nickel lake and Turtle river, Rainy River district.
Riddell siding, 1½ miles N. on C.P.R., eight miles west of Vermilion mine.
Schreiber, 3 miles S., and two miles from lake Superior.
QUEBEC.
Sherbrooke district. (Numerous locations.)



Flow diagram, mill of St. Lawrence Pyrites Company.

The dumps of waste which have accumulated during the earlier mining operations contain much good ore. They are now being sorted over and the concentrating ore is being sent to the mill for treatment.

A small portion of the Eustis ore is utilized at the chemical works at Capelton. The greater part of the ore is shipped out of Canada to various chemical works in the United States. The copper and other values in the

ore are recovered from the cinder at the smelter at Norfolk, Virginia, belonging to the principal owners of the Eustis company.

McDonald mine.—This property is located on lot 22, range I, township of Weedon, about 7 miles south and east of Weedon station on the Quebec Central Railway.

Exploration work was begun in the summer of 1909, by the sinking of small prospecting shafts. The preliminary work showed the existence of a promising body of ore, and more extensive operations were begun, including the sinking of what is now the number one shaft. During the last two years, development and exploration has been carried on systematically, and a considerable tonnage of ore carrying about 5 per cent. copper in addition to the sulphur has been shipped.

There are now two shafts on the property, number one, having a depth of 110 feet, and number two, which in January (1912) had a depth of 260 feet. The total amount of drifting, in January, 1912, was 900 feet, all had been done to block out ore in preparation for stoping. The development work is regarded as having proved the ore body to a depth of 300 feet, and for a distance along the strike of 530 feet. Development work is still being pressed forward, sinking at the rate of about 35 feet per month, and drifting at the rate of 100 feet per month.

The mine is now equipped with a boiler plant having a total capacity of 200 h.p. The air compressor plant is capable of supplying 600 cubic feet of free air per minute. In addition, each shaft is supplied with hoists, that at number two shaft having a capacity of 20 h.p.

An aerial tramway is now being installed to transport the ore from the mine to loading bins at the railway.

At present most of the ore is shipped to the works of the Nichols Chemical Company at Capelton. Smaller shipments have been made to United States points. in ore. In addition a considerable amount of upraising

§President Chas. E. Force, 49 Wall St., N.Y.

The property is operated by the East Canada Smelting Company, Limited.§

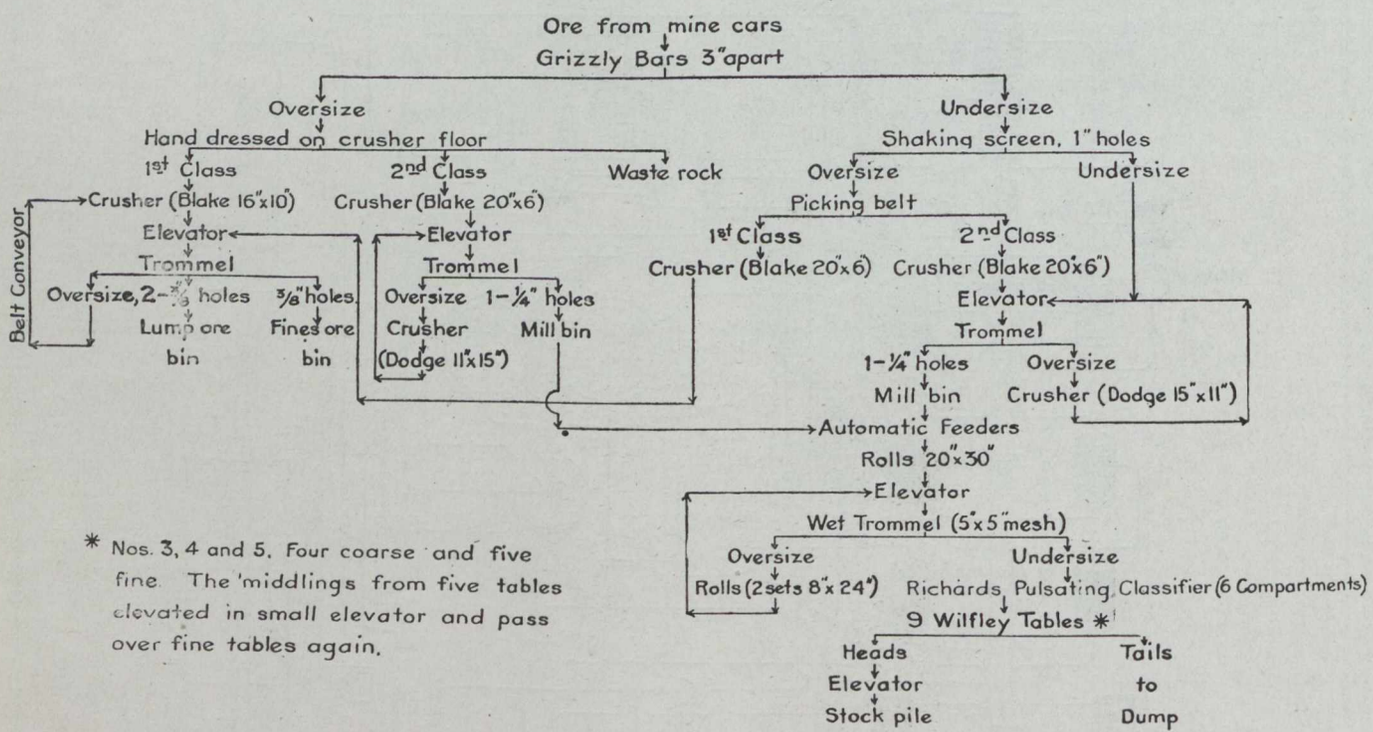
Capelton Mines.—The group of mines which may collectively be named the Capelton mines are located on lots 3 and 4, range VIII, township of Ascot. The original mines were Albert mine on lot 3, range VIII, and the Capel mine on the s.e. ¼ of lot 4, range VIII. With this group should also be included the old Crown mine on lot 4, range IX. As indicated in the reference to the Eustis mine, the ore bodies, first discovered on the Crown property, extend across the boundary towards the southeast, and it is on these ore bodies that the Eustis company is operating.

The first discoveries were made on the Capelton properties about 1863. They were first exploited as gold prospects, but development work soon demonstrated that there was a considerable quantity of cupiferous pyrite available. In the early days of their operation unsuccessful attempts were made to extract the copper by the Henderson process, and the mines were closed. Subsequently the properties passed into the control of G. H. Nichols & Co. This firm at first shipped most of the ore to sulphuric acid works near New York. Subsequently large acid works were established at Capelton, and later a small smelting plant, to treat the richer copper ores and cinder.

The mines were operated, practically continuously for about thirty years, and were finally closed in 1908, the deepest shaft having reach a depth of about 1,800 feet.

Several ore bodies occurred on the property on a strike approximately northeast, all having an inclination towards the southeast. The ore bodies varied in dimensions; in general the form appears to have been lenticular. The width of the several ore bodies varied considerably from narrow vein-like bodies to masses over 50 feet across. A considerable portion of the ore carried over 5 per cent. copper, and on one occasion an ore body of considerable size containing over 15 per cent. copper was encountered.

FLOW SHEET, MILL OF EUSTIS MINING COMPANY



The deposits on the Capelton properties are doubtless associated with big deposit of cupiferous pyrites on the Eustis property. They appear, however, to have carried more copper and to have been more irregular in their distribution.

The known ore bodies appear to have been exhausted and the mines were closed down in 1908. The closing of the mines is said to have been due chiefly to the difficulty of handling the water. Much of the plant has since been removed.

PYRITES IN ONTARIO.

Brockville District.

Brockville Chemical Company.—In 1868, John Cowan and J. B. I. Robertson began mining for pyrite on lot 19, concession II, Elizabethtown township, Leeds county. The pyrite occurred in a series of lenses conformable to the lamination of a highly foliated pink granite gneiss. A series of irregular cavities and iron pyrites in parallel bands, and mining took the form of gouging out the richer shoots of ore, irrespective of any other consideration. No timbering was done, and when a part of the pit became unsafe, work at that point was abandoned. The main pit was sunk to a depth of 250 feet. The strike of the deposits was northeast, and the dip to the southeast. Mining operations ceased in 1879.

The ore from this property was used for making sulphuric acid in Brockville. After the mine was closed, pyrites was obtained from near DeKalb junction in New Hampshire. In a report of the Geological Survey of Canada,¶ the acid works are thus described:

"The Brockville Chemical Company's mine in the township of Elizabethtown has been closed since 1879. The chemical works are, however, still in operation. The pyrite at present used by the company is being brought from New Hampshire at the rate of a carload a day. There are 16 kilns in operation each having a capacity for 300 pounds of ore. The kilns are charged every hour and produce about 85 carboys of sulphuric acid a day. In the distillery there are 21 glass retorts attached to glass receivers for redistilling the crude acid. Besides the above, about 15 carboys of nitric and hydrochloric acid can be produced per day. In this case iron retorts and earthen receivers are used. The company employ 26 men."

A portion of the sulphuric acid was used at a fertilizer works in Brockville. Mixed acid was also supplied to two dynamite works in that neighborhood. One of these was started by C. W. Volney, the inventor of the Volney blasting powders, who afterwards sold out to one Griffin; and the other by Smith and Nelson, who were succeeded by Abbott and Harrison. Operations of all kinds ceased in 1880, and to-day not a vestige of these industries remains.

The cause of the decline and obliteration of these, at one time, flourishing industries was the prohibitive price of raw material. To the cost of mining near DeKalb Junction must be added hauling to the railroad and loading, freight to Ogdensburg, unloading re-loading on wagons and hauling three miles to the acid works. Working on imported ore, the plant could not successfully meet competitors. The evidence of men who worked in the old pits is to the effect that they were never completely exhausted.

McIlwraith Mine.—Lot 5, Concession IV, Darling township, Lanark county. The vein strikes slightly north of east along a contact between diorite on the south and crystalline limestone on the north. It was first opened up many years ago by W. H. Wylie, of Almonte, and Wm. Hall, of Darling, when prospecting for gold. They sank a shaft to a depth of 35 feet. The Nichols Chemical Company instituted mining operations under an option in September, 1899. The old shaft was deepened to 75 feet and from the bottom a drift run 8 feet to the east. A tunnel 150 feet long, with an outside approach of 50 feet was driven along the strike of the vein. This discloses a length of over 90 feet of workable ore, clean high grade pyrite enclosing lenses of quartz. A cross cut of 12 feet to the south failed to pierce the width of the deposit. The lens dips to the south at an angle of 60 deg., and pitches to the east away from the shaft which passed through it. It is claimed that it was caught again by the drift at a lower level. Work ceased at the expiration of the option, the end of April, 1900. Three carloads of ore were shipped. The mining was all done by hand. The gossan cap is 14 feet deep.

In a line of weakness caused by the contact of the diorite with the crystalline limestone, pyrite-bearing solutions have eaten out cavities and lenses in the limestone, depositing in them, pyrite and quartz. These break quite freely from each other, and the only impurity in the pyrite is small intermixed particles of quartz. Allowing for reasonable culling, an average sample from the tunnel, assayed by A. G. Burrows, yielded 42.6 per cent. sulphur, and a sample from a dump of 300 tons removed from the property to an adjoining lot, and which had been exposed to weather for six years, yielded 38.86 per cent. sulphur.

¶C. G. S., 1883, Part L, p. 10.

(To be continued.)

SPECIAL CORRESPONDENCE

NOVA SCOTIA

Dominion Coal Outputs.—The production from the Glace Bay mines in February was not so large as expected, owing to a severe snow-storm and "silver thaw" towards the end of the month. The sleet deposit was the worst for very many years, and completely demoralized all telephone and telegraph communication. About thirty thousand tons of possible output were lost through this storm. The actual outputs for February were, from the Glace Bay mines 336,919 tons and from the Springhill mines 32,155 tons. In March the Glace Bay production will probably be 370,000 tons and the Springhill production 36,000 tons. The net increase for all the Coal Company's mines in the first three months of 1913, as compared with the same period of 1912, will be about 118,000 tons.

Shipping was continued at Sydney until the 17th of February, and, if the drift-ice conditions are favourabel, should recommence towards the end of March. It is quite possible that shipping to St. Lawrence ports may commence about the fifteenth of April, as the ice in the river is not heavy this spring. Indications are that the Cape Breton collieries will ship an unusually large amount of coal to St. Lawrence ports during the coming summer.

Nothing in the progress of the mining industry in Cape Breton is more striking than the changed condi-

tions regarding the working of the collieries in the winter months. The Dominion Coal Company's output for the first quarter of 1913 will be about 1,090,000 tons, which exceeds by 264,000 tons the entire output for the year 1893, the year in which the Coal Company was formed. In 1893 the output for the first quarter was 75,000 tons, whereas in 1913 a single week's production will reach 100,000 tons.

It is perhaps worth while to mention that in March 1913 the Dominion Coal Company will have been incorporated twenty years. In 1893 the output was 826,000 tons for the year. In 1912 the output was 4,513,269 tons, and No. 2 Colliery alone produced a tonnage equal to the entire output of the Company in the year of its incorporation. It is within the probabilities that the 1913 output will reach 4,900,000 tons, in which case the Company will, in twenty years, have increased its production six-fold. It can be safely stated that the Dominion Coal Company is the largest and most important single asset in Nova Scotia, and its prosperity and that of the Province are one and the same.

Cape Breton Coal, Iron & Railway Company.—It is understood that negotiations have been proceeding between this company and the Dominion Coal Company which may enable the Cape Breton Company to recommence operations. It may be remembered that this company opened and equipped a colliery at Broughton, but selected a site for the slopes which rendered it necessary to cross an area owned by the Dominion Coal Company before it was possible to win the main areas of the Cape Breton Company. In the past it was not found possible to come to an arrangement, but it is now probable that the Cape Breton Company will be able to obtain a lease from the Dominion Coal Company, which will enable them to proceed with the sinking of the deeps, and to mine coal. The deeps were sunk as far as the boundary of the Coal Company's property, but work was discontinued about 1907 owing to the impossibility of the deeps proceeding further without trespassing on the Coal Company's areas.

It is further stated that the Nova Scotia Steel & Coal Company may obtain permission from the Dominion Coal Company to mine coal from submarine areas off Sydney Mines belonging to the Dominion Company and adjoining the present undersea workings of the Scotia Company.

ONTARIO

COBALT, SOUTH LORRAIN, GOWGANDA AND ELK LAKE.

Casey Cobalt.—The Casey Cobalt Mining Company went on a regular production basis the week ending March 22nd. The weekly production will amount to 16,000 ounces, of which 6,000 ounces, or enough to make current expenses and leave a profit, will come from the mill as it is at present constitued. When it is treating 50 tons per day instead of its present 25 tons, this will of course be increased in proportion. The duplication of the mill should now not be a matter of any great length of time as all the machinery has been hauled over the clay roads and construction can go ahead rapidly.

As an example of success attained by perseverance under disappointment and difficulties the history of the Casey is illuminating. Situated eight miles out in the clay belt ,where no previous successes had blazed the way the company operated four years without making a cent of profit. The Casey had not the prestige that belongs to the Cobalt camp to help it and transportation difficulties consisting in the haulage over eight miles of bad roads to an island of conglomerate rock in a sea of clay was not calculated to inspire optimism. Patches of high grade ore were discovered and taken out, but nothing of importance was discovered until two years ago when the No. 6, or big vein of the mine, was cut.

It seems most probable that the conglomerate ridge on which the Casey is situated was at one time an island standing out above an arm of Lake Temiskaming. In the swamp below the mine a diamond drill was put down 210 feet before striking rock and close to the mine it had to be sunk over 90 feet before the bottom of the clay was found. The conglomerate ridge is about three miles running from the Casey Mountain where the granite contact occurs to the point where the rock disappears under the heavy overburden of clay. With the exception of three or four claims all this ridge is owned by the English syndicate which put the Casey Cobalt Mining Company on the market. They have 25 claims of 40 acres each, or a thousand acres, which, in the light of developments on the Casey, would all appear to be well worthy of prospecting. Much of this assessment work on these claims is now being done with the diamond drill, not to discover veins, but to establish depth of formation.

Unlike the Cobalt camp, payable ore is not mined from the grass roots down. The No. 1 or Robber vein, as it was called by the old management, was strong and well defined at the 30 and 100-foot level, but there was not more than eight or nine ounces of silver to the ton in the smaltite and niccolite.

The first ore body of any length and size struck on the Casey was the No. 6 at the 210-foot level. It was intersected in a cross cut 150 feet long from the old workings on No. 1 and it is significant that it does not show at all one the surface. It has now been developed for 350 feet, all of high grade, as it is reckoned high grade in Cobalt, that is about 2,500 ounces to the ton. The first car taken out of this vein gave returns to the company of $132,000 and this is the grade of ore right along the shoot. The vein is sometimes from six to nine inches of high grade ore and sometimes it is split up into four or five stringers. It has been drifted upon across the line on to the Kismet property, and here it is as strong as in any place in the whole of the workings. No ore has been shipped from the Kismet yet, though some has been stoped, but as two of the best veins have been definitely followed on to this claim south of the Casey it would appear to be a good prospect.

From the 210-foot level of the No. 6 vein a raise was put up 64 feet in good high grade ore all the way. At the top of this raise there was a patch of lean ore, but after drifting 25 feet to the south of the No. 2 raise, it came in well again and promises to develop finely on this level. Below the 210 or main level on the No. 6 vein another level has been opened up at the 260-foot and here again high grade has been encountered and a fair body of ore can be reckoned on in the reserves, but in drifting to the north the Keewatin contact is reached and as in Cobalt values disappear when the conglomerate is left. A small shoot of high grade ore was mined in the keewatin, but as a general rule the same conditions apply as on the West Ridge at Cobalt, where exploration in the keewatin under the conglomerate has not proven at all remunerative. The average depth of the conglomerate in the Casey is about 250 feet from

the collar of the old shaft, but as it dips to the south it will probably be considerably deeper on the Kismet. As in Cobalt the highest grade ore in the widest ore bodies is found close to the keewatin—conglomerate contact.

The success which attended the opening up of the No. 6 vein led to the further exploration of No. 1, and it is now to be credited with a good body of ore. A cross cut was driven from the end of the old workings at the 100-foot level and at a distance of 200 feet a 60-foot shoot of high-grade ore was developed. On the same vein ore has also been found at the 160-foot level near the south boundary and in a winze put down 24 feet at a point 200 feet north from the shaft milling ore has been discovered so that there is every possibility of blocking out a good length of milling ore with some patches of high grade. The milling ore runs about 40 ounces to the ton. There are other veins, but they have not received much development to date.

The Casey Cobalt consists of 120 acres altogether, two claims together and one on Sutton Bay, near Lake Temiskaming. The eastern of these two claims has not been developed at all and on the one property not more than three acres have been touched. The Kismet claim is being developed from the Casey. A shaft has been sunk on the Townsite Extension and one or two veins cut. This is all the work going on at present, development in this isolated section being confined absolutely at the present time to the Casey Cobalt and associate interests.

The new shaft should soon be completed, when many of the difficulties that have hitherto attended the raising of ore will be removed. It has been found that it is cheaper to pay the settlers $2.50 a cord to cut wood than to haul coal from New Liskeard, and there are probably 5,000 cords in the yards now, but this summer arrangements will probably be made whereby the fuel bill will be cut down very materially.

During the year 1912 the McKinley-Darragh produced 2,717,383 ounces of silver worth $1,621,010. The total net profits on operations were $1,153,848. The total cost per ounce was 18.59 cents, leaving a profit of 43.07 cents per ounce. The ore reserves now developed show a total of 152,800 tons, estimated to contain 5,368,500 ounces of silver, 100,400 tons from the McKinley containing 4,133,500 ounces, and 52,400 estimated to contain 1,235,000 at the Savage. This compares with 5,561,780 ounces in 1912. While 2,717,383 ounces were produced during the year, the ore reserves were increased by almost 200,000 ounces. After paying $1,123,646 (including the first of January disbursement) there was a surplus of $422,326.

Lawson Progress.—The Lawson has discovered another good ore shoot on the No. 8 vein at the 115-foot level. In a raise 270 feet from the No. 8 shaft, a shoot of very spectacular ore has been discovered and has been developed for some distance. Th ore will run from 5,000 to 10,000 ounces to the ton.

High Grade on Temiskaming.—At the 575-foot level of the Temiskaming mine there has now been developed a shoot of high-grade ore from 65 to 70 feet long, with prospects of its continuing for some distance. The vein is from three to four inches wide, of 2,500 ounce ore, and there appears good prospect of making a tonnage of milling rock in the wall rock. This is the first ore body of any length and size the Temiskaming has been able to develop in the diabase below the keewatin.

PORCUPINE AND SWASTIKA.

McEaneny Mill.—The five-stamp mill at the McEaneny is making $500 a day, or enough to pay all current expenses and leave a good profit. Another five stamps will be installed almost at once, as accommodation has been left for them in the present building. For the first half of the present month the heads to the mill ran $35 to the ton on an average. As this first instalment of the mill was designed more as a sampling plant than as a revenue producer, the results obtained are regarded as highly satisfactory. Regular clean ups are being made, bullion will be shipper every month, the first consignment going out at the beginning of the month.

Development continues to be most gratifying. The ore shoot at the 200-foot level is now 600 feet long. The south face is now five to six feet of ore, assaying $40 to the ton. All the ore going through the mill is coming from development or the dump.

Lucky Cross.—At a distance of about twelve feet from the shaft a cross cut has penetrated the No. 16 vein of the Lucky Cross mine at Swastika, at the 200-foot level. The vein looks promising. Most of the machinery has arrived for the new mill and it is expected that it will be running by the first of April. The mill at the Swastika mine is already in operation. At Kirkland Lake there is much prospecting activity and a good many claims have changed hands.

There has been a fresh outbreak of lawlessness at Porcupine very largely owing to the withdrawal of provincial police from the camp. Non-union men going to and fro between the towns and their work have been waylaid and manhandled. These occurrences became so frequent that the non-union men at the mines united and proceeded to reprisals. At Timmins, Mayor Wilson read the Riot Act when he heard that a clash was likely between the non-union men and the union men and the situation looked dangerous. Fifteen provincial constables have been rushed back into the camp and they should be able to cope with the situation. There are over a thousand men now working at the various mines and not more than 200 strikers still remain in the camp.

Jupiter At Work.—The Jupiter has started work again under its new mine manager, Mr. Little, Mr. R. W. Brigstocke remaining as consulting engineer. The Porcupine Gold Mines is now ready to start work again on the Vipond and nearly every company that had any pressing need to resume at once is developing again.

BRITISH COLUMBIA

Generally, mining continues to make good progress in various parts of the province, the chief exception being at the coal mines on Vancouver Island, of the Canadian Collieries (Dunsmuir) Limited. However, this company is succeeding in operating its Comox colliery, with mines about Cumberland, and getting out a considerable tonnage of coal, though not as much as before the miners went on strike. No coal mining is yet being done at the company's Extension colliery mines, efforts being concentrated in keeping open those first above-mentioned. In Kootenay district the only present evidence of labor difficulty is that given by a strike of miners at the Queen gold mine, Sheep Creek camp, Nelson mining division. If it be the intention of the Western Federation of Miners to call its members out of Slocan mines following the adverse majority report of the Board of Conciliation that investigated the conditions in connection with the demand of the Union for an increase of 50 cents a day in the men's wages, there is not yet any indication of such intention. It has been reported that both the Granby and Hedley mining companies have reduced wages 25 cents

a day, in accordance with their announced intention of doing so under the sliding scale arrangement made when the price of copper went up. It is significant that the Britannia Company, which the Western Federation is fighting, is continuing to pay the higher rate which it voluntarily gave its men last September. If it be true that the Granby and Hedley companies have reduced the men's wages the position is that the Britannia Company is still paying the high price copper rate, notwithstanding that it is entitled to lower the rate to the old scale in force before the price of copper went up.

Slocan and Rossland.—These districts are associated in this notice for the reason that some information follows relative to the Le Roi No. 2, Ltd., and the Van-Roi Mining Co., the latter being an auxiliary company of the former.

The report of the Van-Roi Mining Co. for its last fiscal year shows that of 4,488 ft. of development work done, 3,470 feet was drifting and cross-cutting, and 1,018 ft. raising and sinking. The average cost of this work was $8.91 per foot. The quantity of ore concentrated was 54,115 tons, assay returns of which showed average valuable metal contents to have been 15.02 oz. silver per ton, 3.66 per cent. lead, and 6.26 per cent. zinc. The mill products were: Lead concentrate, 2,392.5 tons, containing 179.75 oz. silver per ton, 60.2 per cent. lead, and 11.1 per cent. zinc; and zinc concentrate, 2,570.5 tons, containing 60.8 oz. silver per ton, 3.7 per cent. lead, and 45.1 per cent. zinc. The total metal contents of the 4,963 tons of concentrates were: Silver, 556,363 oz.; lead, 3,070,640 lbs.; zinc, 2,848,860 lbs. In addition there was 712 oz. of silver, 1,860 lbs. of lead, and 3,000 lb. of zinc in six tons of ore shipped crude. The cost of mining the ore was $2.58 per ton, which was a little higher than that of the immediately preceding fiscal year. Cost of concentrating was 95 cents a ton. The Van-Roi mine and mill are situated within half a dozen miles of Silverton, Slocan Lake.

The annual report of Le Roi No. 2, Limited, owning the Josie, No. 1, and other properties in Rossland camp, shows that during the company's last fiscal year development work consisted of 5,817 feet of drifting and cross-cutting, and 298 feet of raising and sinking; total 6,115 feet. The quantity of ore mined was 40,112 tons, of which 18,257 tons was shipped crude to the Trail smeltery, and 17,116 tons was concentrated, the latter yielding 1,659 tons of concentrate. Assay returns showed that the ore shipped contained 0.7754 ounces gold and 0.6727 ounces silver per ton, and 1.39 per cent. copper. The concentrate contained 1.096 ounces gold and 0.643 ounces silver per ton, and 1.14 per cent. copper. Average value of the ore was $20.10 per ton, as compared with an average of $21.08 per ton for 27,098 tons shipped in the previous year. Concentrate averaged $25.75 per ton. Mining costs appear to have been $3.46 per ton, and smelting charges $5.77; while development charges and deduction for depreciation together come to $2.95 per ton; total per ton, $12.18, as compared with $11.41 for the preceding fiscal year. By arrangement with the Consolidated Company, boundaries between the respective properties of the two companies were adjusted, extra-lateral rights relinquished, and all claims for trespass, etc., waived.

At the meeting of the Le Roi No. 2, Limited, held in London during February, in the course of his address to shareholders, the chairman said: "One of the pleasantest features of the present Le Roi No. 2 position is the success which has attended the Van-Roi mine during the past year. That mine shows a net profit of £27,000 odd, and, though the last few months' workings have been disappointing, there is not the slightest doubt that this is only temporary, and due to causes easily explained, and that we may now safely regard the Van Roi as a profit-earner and a dividend-payer. It looks, indeed, as though the situation which was originally anticipated is about to be realized, namely, that when the Le Roi No. 2 production may be temporarily at a low ebb its receipts should be kept up by dividends from the Van-Roi mine. This is exactly what would have been the case at the present moment, had not the Van-Roi profits to go to pay off the capital debt which the mine had contracted."

Coast District.—The most important recent occurrences in connection with metalliferous mining in the Coast district have been those that resulted in the calling out, by the Western Federation of Miners, of between 600 and 700 men who had been employed by the Britannia Mining and Smelting Company, at its copper mines, concentrating mill, and auxiliary works, at and near Britannia Beach, Howe Sound. This action on the part of the miners' union had been threatened for some time, although it was hardly expected it would take place until several weeks later. The position was that last year a Board of Conciliation and Investigation having been held, a majority report recommended that the company withdraw its refusal to permit union officials to visit its mines to collect union dues, hold meetings, etc. The representative of the company on the board did not subscribe to the majority report, nor has the company since yielded on the point. The situation is an unusual one, for the company owns a large area of land surrounding its mines, together with the camp sites, all buildings, boarding and bunkhouses, landing dock, foreshore, etc. For some time it permitted union representatives to visit its camps, but eventually, concluding that (notwithstanding that there were not any complaints concerning working conditions, rates of wages, accommodation, etc.) this concession was being made use of to the detriment of its own interests, it forbade such visits and the holding of union meetings in any of its buildings. In support of its action it is claimed by its representatives that the company having done everything in reason for the comfort, and even for the recreation of its employees, it is well within its rights in the stand it has taken and is maintaining. In addition, it is urged that it has even gone farther than most other mining companies in expending money for the benefit of its employees, who, consequently, have no reasonable cause for complaint. It is a fact that for a long while those who financed the company found its operations a heavy drain at a time of monetary stress in the United States, where the chief owners reside. Well on for $1,500,000 was advanced to the company by Mr. Grant B. Schley, of New York, and his associates to carry out the work of development to explore the mine, and this was in addition to much money that earlier had been spent on similar work. The direct result of the enterprise of Mr. Schley and associates was that much ore of a payable grade was found, and production became important. In 1911, there was mined nearly 119,000 tons of ore, containing 46,000 ounces of silver and 8,685,000 pounds of copper; while in 1912 the output of ore was increased to 193,000 tons, containing between 70,000 and 80,000 ounces of silver and between 14,000,000 and 15,000,000 pounds of copper. For some time past 60 to 700 men have been employed by the company, and the daily outlay in wages and materials, including construction and substantial additions to plant and equipment, was approximately $6,000 a

day. No other metalliferous mining enterprise on the British Columbia coast has in recent years approached this, neither in magnitude nor results. Yet the Western Federation of Miners says, in effect, we will not allow you to spend your own money in your own way, not if we can prevent it. However, the management of the company is not to be deterred from its course and at the time of writing it is operating its concentrating mill 20 hours a day, with two over-time shifts of 10 hours each, instead of the customary three 8-hour shifts, and is running its three-and-a-half mile aerial tramway from the mines down to the concentrator under similar conditions, and getting down practically three-quarters of the usual quantity of ore, while at the mine two shifts of men are delivering the ore to the tramway. Besides this, the work of driving the 5,000-foot cross-cut tunnel, the object of which is to open the mine at much greater depth and allow of delivery of ore to the tramway at a point half-way down the mountain, and so expedite transportation to the mill, has been resumed.

COMPANY NOTES

NOVA SCOTIA STEEL AND COAL

The annual meeting of the Nova Scotia Steel & Coal Company shareholders, held at New Glasgow on March 26th, was well attended. In every phase of the work carried on in the different plants in the past year, the efforts have shown substantial increases. An assurance that a good year was in store was announced by President Harris, who said that the total steel output for the first half of the year had already been contracted for at an improved price. The coal output would be larger and the prices maintained, while from the ore mines they anticipated a record yield at splendid prices. Of the new work outlined for the year, a new open-hearth furnace would be installed at Sydney Mines, a new colliery opened there, and some new equipment installed at Wabana. The retiring board was re-elected.

ASBESTOS CORPORATION.

The Asbestos Corporation of Canada held its first annual meeting recently, when reports for the seven months ended December 31st were read by the president, Mr. W. G. Ross. The old board was re-elected for the ensuing year, as follows: W. G. Ross, president; H. E. Mitchell, vice-president; C. W. Colby, H. J. Fuller, Uzal H. McCarter, Thos. McDougall and William McMaster.

HOLLINGER'S LATEST.

Profits of the Hollinger Gold Mines from January 1st to February 25th, according to the regular four weekly report being sent out to-day, with dividend cheques, were $241,600. This added to the surplus brought forward from 1912, makes $593,402, less two dividends of $180,000, leaving a surplus of February 25th of $412,402. In the four weeks ended February 25th hte mill ran 91 per cent. of the possible running time, treating a total of 9,240 tons, or an average of 330 tons per day.

STATISTICS AND RETURNS

LA ROSE FOR FEBRUARY.

La Rose's February statement shows a total production for the month of 230,102 ounces of a value of $136,182. This, with sundry income of $2,330 for the month, brought the total up to $138,512. With cost of marketing and other expenses deducted, a balance of $81,103 was left for the month. The financial position of the company, on February 28th, showed cash on hand of $1,425,886, outstanding shipments of $184,032, and $78,017 in ore ready for shipment.

COBALT ORE SHIPMENTS.

Shipments for the week ending March 15th were almost double the amount of the previous week and the bullion shipments were also away above the average. Altogether thirteen mines were represented on the list, but only two sent out more than one car of ore. These two being the Dominion Reduction, shipping concentrates, and Kerr Lake sending out one car of high-grade and one car of low-grade. Drummond shipped concentrates, Bailey Cobalt high-grade, Right of Way low-grade, and Chambers-Ferland low-grade.

The shipments for the week in pounds are:

Mine.	High	Low	Lbs.
Nipissing	..	1	106,840
Beaver	1	..	43,000
Dominion Reduction	2	..	127,300
Peterson Lake	1	..	81,000
Townsite	1	..	66,100
La Rose	1	..	70,500
Drummond	1	..	61,479
Bailey Cobalt	1	..	41,830
Right of Way	..	1	63,278
Chambers-Ferland	..	1	64,000
Cobalt Lake	1	..	64,482
McKinley	1	..	58,309
Kerr Lake	1	1	121,290
	11	4	969,708

The bullion shipments for the week were:

Mine.	Bars.	Ounces.	Value.
Nipissing	85	103,152.80	$61,108.03
Buffalo	60	66,918.00	34,000.00
Crown Reserve	38	43,000.00	26,000.00
Colonial	1	635.00	374.00
Dominion Reduction	34	38,474.40	23,084.64
	218	252,180.20	$144,566.67

BRITISH COLUMBIA ORE SHIPMENTS.

For the year to date the total ore production is 570,008 tons. Smelter receipts for the week ended March 22nd were 47,725 tons and for the year to date, 491,678 tons. Ore output and smelter receipts in detail:

Boundary.

	Week.	Year.
Nickle Plate, milled	1,500	18,000
Knob Hill	28	819
Ben Hur	95	1,621
United Copper	63	1,179
No. 7	62	562

Lone Pine	133	274
Granby	27,255	264,568
Mother Lode	8,280	74,318
Rawhide	4,870	57,750
Napoleon	584	8,173
Unnamed	151	929
Other mines	...	1,998
Total	43,021	430,191

Rossland.

Le Roi No. 2, milled	350	4,200
Inland Empire, milled	100	1,200
Centre Star	2,726	32,981
Le Roi	987	14,025
Le Roi No. 2	489	5,279
Other mines	...	160
Total	4,652	57,845

Nelson.

Mother Lode, milled	500	6,000
Second Relief, milled	200	2,400
Queen Victoria	531	6,789
H. B.	98	2,238
Emerald	77	553
Other mines	...	7,580
Total	1,406	25,560

Lardeau.

Other mines	...	137

Slocan and Ainsworth.

Standard, milled	500	6,000
Van Roi, milled	1,100	13,300
Bluebell, milled	1,200	14,400
Kilo, milled	100	1,200
Rambler-Cariboo, milled	300	3,600
Standard	363	3,653
Bluebell	89	2,205
Eastmount	31	90
Rambler-Cariboo	211	721
Idaho-Alamo	34	62
Hope	34	238
Other mines	...	1,385
Total	3,862	46,854

East Kootenay.

Sullivan	534	8,353
Other mines	...	363
Total	534	8,716

Consolidated Co.'s Receipts.

Trail, B.C.

Knob Hill	28	819
Ben Hur	95	1,621
United Copper	63	1,179
No. 7	62	562
Lone Pine	133	274
Standard	363	3,653
Bluebell	89	2,205
Eastmount	31	90
Rambler-Cariboo	211	721
Idaho-Alamo	34	62
Hope	34	238
Le Roi	987	14,025
Le Roi No. 2	489	5,279
Centre Star	2,726	32,981
H. B.	98	2,238
Emerald	77	553
Sullivan	534	8,353
Other mines	...	4,299
Total	6,054	79,151

B. C. Copper Co.'s Receipts.

Greenwood, B.C.

Mother Lode	8,280	74,318
Rawhide	4,870	57,750
Napoleon	584	8,173
Queen Victoria	531	6,789
Unnamed	151	929
Total	14,416	147,959

Granby Smelter Receipts.

Grand Forks, B.C.

Granby	27,255	264,568

SILVER PRICES.

	New York. Cents.	London. Pence.
March 11	58⅜	65¼
" 12	57⅞	64⅞
" 13	57⅞	64¾
" 14	56⅞	64⅝
" 15	57½	..
" 17	57⅛	64⅜
" 18	56⅞	64⅜
" 19	56⅞	64⅛
" 20	56⅞	26 3/16

TORONTO MARKETS.

March 25.—(Quotations from Canada Metal Co., Toronto):
Spelter, 6.25 cents per pound.
Lead, 4.25 cents per pound.
Antimony, 10 cents per pound.
Tin, 50 cents per pound.
Copper, casting, 16 cents per pound.
Electrolytic, 16 cents per pound.
Ingot brass, 11 to 15 cents per pound.

March 25.—(Quotations from Drummond, McCall & Co., Toronto):
Summerlee No. 1, $26.00 (f.o.b. Toronto).
Summerlee No. 2, $25.00 (f.o.b. Toronto).
Midland No. 1, $20.50 to $21.50 (f.o.b. Toronto).
Nidland No. 2, $20.50 to $21.50 (f.o.b. Toronto).

GENERAL MARKETS.

Coal, anthracite, $5.50 to $6.75.
Coal, bituminous, $3.50 to $4.50 for 1¼ inch lump.

Coke.

March 20.—Connellsville coke (f.o.b. ovens):
Furnace coke, prompt, $2.45 to $2.50 per ton.
Foundry coke, prompt, $3.00 to $3.50 per ton.

March 20.—Tin, Straits, 46.25 cents.
Copper, Prime Lake, 14.85 to 14.95 cents.
Electrolytic copper, 14.80 to 14.90 cents.
Copper wire, 16.00 to 16.25 cents.
Lead, 4.35 to 4.40 cents.
Spelter, 6.15 to 6.25 cents.
Sheet zinc (f.o.b. smelter), 8.25 cents.
Antimony, Cookson's, 9.00 cents.
Aluminium, 26.50 to 27.00 cents.
Nickel, 40.00 to 45.00 cents.
Platinum, ordinary, $46.00 per ounce.
Platinum, hard, $51.00 per ounce.
Bismuth, $2.00 to $2.25 per lb.
Quicksilver, $39.00 per 75-lb. flask.