

THE CANADIAN MINING JOURNAL

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EDUCATION IN NOVA SCOTIA

We notice with decided pleasure the definite step which Nova Scotia has taken in appropriating a large sum of money for the purpose of establishing an Institute of Technology in Halifax. This institute, however, is to be but one part of the Local Government's plans. To quote from the Halifax Morning Chronicle:—

"The outstanding features of the scheme, which embraces the most complete system of technical education possessed by any Province of the Dominion, or any State of the American Union, are:—

"1.—The establishment of a central institution of university grade in the City of Halifax, to be called the 'Nova Scotia Institute of Technology,' for the purpose of affording instruction and professional training in metallurgical, civil, mining, mechanical, chemical and electrical engineering, and for the purpose of scientific research.

"2.—The establishment of subsidiary technical schools in industrial centres.

"3.—The continuation and enlargement of the Government mining schools, under the director of the Director of Technical Education.

"4.—The appointment of a Director of Technical Education, who will be Principal of the Nova Scotia Institute of Technology, and who will have supervision over the entire system of technical education."

The establishment of subsidiary technical schools appears to the JOURNAL to be a work of supererogation. Nova Scotia already has a good system of high schools and academies. In these students could be prepared for the central institute. Energy will be dissipated and misapplied in duplicating the work of the central institution. Far better were it to concentrate all expenditure and effort upon making the Institute of Technology a credit to the province.

For long Nova Scotia has felt the need of such a foundation. Her young men have been trained for the ministry, for law, and for commerce. She has supplied far more than her quota of eminent politicians and has produced not a few statesmen. Of mariners she has been prolific. Hardly a ship that crosses the Atlantic does not carry a Nova Scotian as captain or mate. But to prepare her sons to develop and conserve her vast mineral wealth she has hitherto done but little.

Dalhousie University, although handicapped by lack of funds and sadly restricted in the matter of accommodation, has, for the past few years, attempted to provide a mining and metallurgical course for a rapidly increasing number of students. Despite adverse conditions, very satisfactory work was done, and is being done.

The overcrowding of the Dalhousie School of Mining, and the plucky manner in which the college staff were attempting to meet the tremendous demands upon their energy, have doubtless been factors in awakening the Government to a proper sense of the country's need. But to the unremitting ardour of the president of the Nova Scotia Mining Society, and to the zeal and enter-

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prise of the editor of a weekly paper, is due a large share of the credit in carrying the movement to a successful issue.

ON SAMPLING

It is an axiomatic truth that not one man in one hundred is capable of sampling an ore-body or stock-pile fairly and without prejudice. Although this truth is recognized, it is not acted upon in very many cases. A feeble assent will be accorded it, but sampling is even now largely left to inexperienced youths. When sampling is done as a step in the mining or metallurgical processes of an operating company, there may be and there often is, gross laxness. When that company is selling a product of mine or smelter, another element is imported into the sampling. It is easily recognized then that loss may follow hard upon the heels of carelessness or ignorance, and errors are guarded against with elaborate pains.

To the lay mind, sampling signifies little beyond securing a "chunk" of ore, or other material, and having it analyzed. But we have seen men of light and learning in technical matters gravely submit a sample, a hand-picked specimen. As, almost invariably, higher results are obtained from the "specimen" than from the legitimate sample, it is obviously a hard task to combat this particular perversion. Even the painstaking labor of an experienced sampler is sometimes vitiated by his personal predilections or prejudices. Suppose that he is sampling a stock-pile, over which there has been a dispute, and that he is one of the disputants, it is harder for a camel to pass through the eye of a needle than for that man to dispossess his mind of all preconceptions. Not a few devices, some of them ingenious and some merely silly, have been suggested with the object of eliminating the personal equation. One expedient, the offspring of a vagarious brain, consists in tearing up a sheet of paper in small pieces and throwing a handful of these pieces with the wind at intervals over the ground to be sampled. A piece of ore is then taken wherever paper has fallen. One trial of this method is sufficient.

But we wander from our overdue moral. The point which emerges from all this is to this effect, that to fairly qualify as an ore sampler a man must be honest first of all; and that, further, he must be intelligent and observant. Even then he may fail lamentably.

CONCERNING OTTAWA

It is announced from Ottawa that a Deputy Minister is to be appointed to assist the Hon. Mr. Templeman in administering his Department. The office is being created, and its creation will entail a sub-division of responsibility. The Deputy will have control of the Mines Section. The present Department of Mines, and a portion of the Geological Survey, will come under his jurisdiction. The need of such an office is not apparent. But, granting that there be such a need, the selection of a suitable Deputy should be a matter of most careful consideration. Never before has so much depended upon the proper and responsible exploration of our country. Interest in mining and in metallurgical process is at its flood. With the encouragement and with the intelligent assistance from an organized corps of Government geologists, and other specialists, we shall go on from strength to strength. Much, very much,

depends upon that help. The efficiency of that help may be destroyed by hasty or ill-considered action on the part of the Government. To state the matter plainly, we strongly urge that, since such a position is to be created, the incumbent be a man, not only of recognized administrative ability, but also of attainment and eminence in the very work which he is to supervise. This is essential. The intrusion of politics in such an appointment as this—a contingency which we hope is indeed remote—would be a lasting blot on the Department's fair name, and a sure precursor of bickerings, strife and incompetency.

LARDER LAKE

At date of writing, more than 3,000 claims have been registered around and about Larder Lake. Company after company is being floated with capitalizations which make one dizzy.

At risk of falling into that obnoxious category of human beings designated "knockers," we wish to express our views. Pick up a prospectus of a Larder Lake company. Read it with care. In almost every case you will see the claim made that fabulously rich assay values have been found close to the property being exploited. In some rare cases these values, it is stated, have actually been found upon the areas of the company whose prospectus you are reading. But it is very generally true that the majority of Larder Lake properties are valued on an entirely assumptive basis. The district is hardly yet in the initial stage of development. Not until late in April can systematic prospecting be undertaken. And yet thousands of dollars are being invested in possibilities! Improbabilities even are being capitalized at astounding figures!

We have not a word to say against Larder Lake as a legitimate and likely field for prospecting. Of its geological probabilities and limitations we are not now competent to speak. But no camp can survive the reckless and insanely unbusiness-like "boom" to which this place is now being subjected.

We wish to add one word in closing, and it is this. When statements of assay values are quoted in any prospectus, it is safer and saner to ignore them altogether unless signed affidavits describing the exact places, conditions and method of sampling, the name of the sampler, the name of the assayer, the size of sample and the circumstances under which it was shipped can be obtained. This is one very necessary and very much neglected preliminary step. You have, at this point, sufficient information to justify you in making further inquiry. Your next step is to engage a competent consulting mining engineer to go over the property in question and report upon the feasibility of beginning mining operations. In brief, there is no reason under the sun why mining should not be approached in the same business-like attitude which is characteristic of the successful merchant.

THE PROSPECTOR AGAIN

Again we sing the Prospector. We, who of late bepraised and applauded him, do now desire to dilate upon his sinister aspects. A knock resounds upon our editorial door. A lean and cheerful individual enters. From his person emanates the fragrance of black rum and of the narcotic plug. From his pocket leaps the specimen, a lump of quartz besprent with gold—gold

glittering and obvious. He relates his tale. The specimen is but a fragment of a mountain of silica and free gold. He convinces us that in this admixture free gold predominates. Animated by a spirit totally contrary to the commercialism of to-day, he tells us that we may to the purchase a half interest for a paltry sum. We blushing demur. We cannot rob him thus. He becomes vehement. We demur some more. At last, red and wrathful, emitting many unkind words, he leaves us.

CANADIAN MINING INSTITUTE

The Canadian Mining Institute held its ninth annual meeting at the King Edward Hotel, Toronto, on the transacted, and papers, written by men eminent in their profession, were read and discussed. On the evening of the 7th the annual dinner afforded relaxation. The convention, which was an unqualified success, culminated in a two days' visit to Cobalt.

Not in the papers read, nor in the discussions which followed, nor yet in the dinner, lay the principal value of this meeting; but, rather, in the fact that several hundred keen, observant men from every part of Canada were given an opportunity of meeting each other.

A distinguished body of American visitors lent an international tone to the assembly.

The good accomplished by such a meeting is not to be measured. Indirectly, an immense, though indefinite, aggregate of beneficial results may justly be attributed to it. Younger members of the society receive inspiration; older members rub off the encrusting barnacles, and all are brightened and strengthened.

The retiring president, Mr. G. R. Smith, filled the chair with tact and never-flagging enthusiasm.

That careful custodian of the funds, Mr. J. Stevenson Brown, made the most favorable report that the Institute has yet received.

The Institute is deeply indebted to both of these gentlemen, as it likewise is to Mr. H. Mortimer-Lamb, the secretary, who wrought diligently to make the 6th, 7th and 8th of March. For three days business was exceedingly a success. Mr. Lamb also was responsible for the very dainty menu card.

POSTAL REGULATIONS

The postal treaty between Canada and the United States expires on May 7th next. It has been proposed that the Canadian Government increase the rate of postage on American periodicals to such an extent as to practically exclude certain classes of journals altogether.

THE CANADIAN MINING JOURNAL has no objection to present against a policy which would tend to diminish the overwhelming flood of obnoxious "literature" with which we are being swamped nowadays. But against any measure which would in any way injure or handicap the circulation in Canada of reputable American technical and scientific periodicals, we must register our unqualified dissent. There is ample room for all such journals. The scope for effort and development in Canada, in matters technical and scientific, is ample. Canada's needs are various. It were both shortsighted and ungenerous to place restrictions upon publications whose missions are the dissemination of knowledge and the fostering and advancement of our most important industries.

EDITORIAL NOTES

Some weeks ago, too late for insertion in the last number, the JOURNAL received an entertaining letter from Dr. A. E. Barlow. Dr. Barlow wrote from Liverpool, in the best of spirits and health. We are sorry the limitations of space will not permit us to publish excerpts from the letter, one part of which contained a very refreshing description of a winter voyage across the Atlantic.

The Premier of British Columbia in a recent speech asserted that more progress had been made in the development of metalliferous mines during the last year than in any three previous years combined. This fact he attributed to the policy of his Government in introducing no legislation to disturb existing conditions, and he stated emphatically that this policy would be pursued.

An Order-in-Council bearing upon the oil and coal territories of Southeast Kootenay, passed in 1904, declared coal and oil licenses to be issued at the risk of the applicant.

This resulted in confusion and litigation. The British Columbia Government is now introducing an act to rectify matters.

In February's *Labor Gazette* almost all mining districts are reported as active or busy. Edmonton, Alta., Nelson and Nanaimo, B.C., are classed as "very busy." Among the changes in wages and hours recorded is the grant of a bonus of ten per cent. on the gross earnings of its employees by the Western Fuel Company of Nanaimo. The grant is contingent upon the continuance of present conditions in the coal trade. The Wellington Coal Company granted an advance of ten per cent. from January 1st.

As a result of changes in wages during the last quarter of 1906, 1,129 miners were affected, their total weekly earnings being increased by \$1,410. The companies granting these concessions were the Cumberland Railway & Coal Company, Springhill, N.S.; the Thetford Asbestos Mines, Que.; the Imperial Oil Company, of Sarnia, Ont., and the British Columbia Copper Company, of Greenwood, B.C. During the month of January, 1907, fourteen miners were killed and twenty-two

When the new Mines Taxation Act becomes law an added obligation will be imposed upon the Ontario Government. In proportion as any mining district contributes to the revenue of the Province, so should the Government acknowledge its responsibility for the construction of good roads, the enforcement of sanitary arrangements in camps, and the many other duties which are the functions of an enlightened administration.

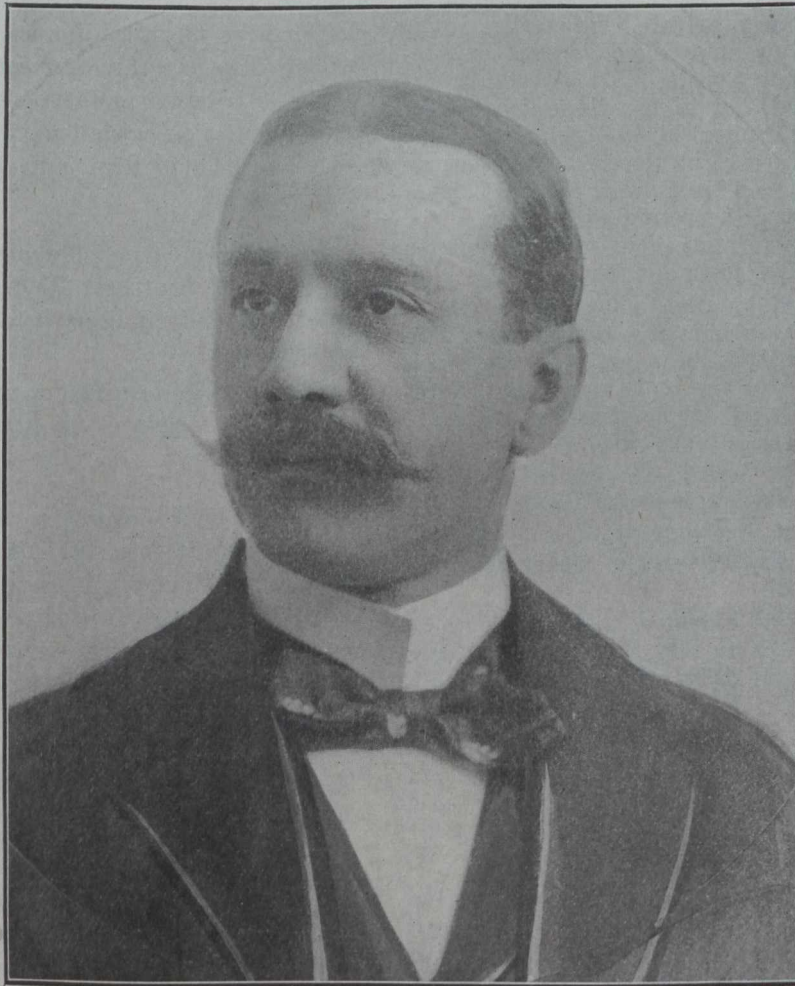
THE CANADIAN MINING INSTITUTE

INAUGURAL ADDRESS BY PRESIDENT GEORGE R. SMITH

OPENING ADDRESS

President: Gentlemen, just a year ago, in opening the eighth annual meeting of the Canadian Mining Institute, I was at that time afforded the exceptional pleasure of welcoming you to the cradle of Canadian nationality, that ancient capital of an old French Province so justly

pared with the two and a half centuries which have elapsed since the French Minister of State rendered his powerful patronage to the first practical mining essays in New France. It is said, nevertheless, that as early as 1660 the Jesuit missionaries reported gold having been found on St. Joseph's Island, in Lake Huron, and Mr. Merritt tells us that copper ore was actually worked



RETIRING PRESIDENT—GEORGE R. SMITH

renowned for its wealth of historical association, and its peculiarly beautiful surroundings.

To-day it is my privilege to greet you in the magnificent Queen City of the great and wealthy sister Province of Ontario. Last year we peered together through mists of vanishing years into the early days in the history of New France, when the development of mineral wealth in North America by European settlers was aided by the fostering care of that great French Minister, Colbert. To-day we meet in a Province possessing, I believe, the youngest Bureau of Mines of any of the older Provinces of the Confederation, and in which State encouragement and recognition of the mining industry can scarcely be traced back more than fifteen years, as com-

in this Province in the vicinity of Point of Mines or Mica Bay as early as 1770, an English company having sunk a shaft into a vein, which afterwards decreased, and was abandoned. I am not going into the details of the early operations of the Bruce Mines, or the circumstances which attended the production in 1880 in Leeds county of iron manufactured from ore exploited in that vicinity. For a great number of years the mining development of this Province was extremely intermittent, chiefly owing to the fact that no smelting was carried on here, and that the demand for ore came chiefly from the other side of the international boundary line. Yet, in recent years, the advance of mining operations in Ontario has been little short of marvellous.

Metallic productions alone in Ontario increased from \$2,565,286 in 1900 to \$5,321,677 in 1904. And from 1904 to 1907 I do not think anyone would dare to predict what they will be, but there is little doubt there will be an increase. The output of silver, cobalt, iron ore, pig iron and steel was given as nil in the report of the Bureau of Mines for 1895, and in 1904 the output of silver was placed at \$111,887; of cobalt, \$36,620; iron ore, \$108,068; pig iron, \$1,811,664, and of steel, \$1,888,349. The report of your Minister of Mines for 1905 claims that the Sudbury nickel-copper deposit constituted the chief source of the world's supply of nickel. The output of nickel in that year was given as \$3,344,409, while the copper contents of the matte amounted

the keenest interest in the industry, but has also borne in mind in his recent legislation the protection that is due to individual rights. I would not, however, lead you to believe that you hold all the silver and other good things in the country. We, in Quebec, on your eastern boundary, have a great undeveloped mining territory within ten or twenty miles of you in the Temiskaming country. You are more fortunate in your Cobalt district than we in our ore, because of the railway facilities which you have. The railway development gives you direct transportation facilities to the very mouth of your most valuable mines, yet it is only a question of time when we, too, shall have railway communication with the great northern mineral belt of



PRESIDENT—MR. FREDERIK KEFFER, GREENWOOD, B. C.

to \$671,833, and if these products had been computed at the price of refined metals, as is done by many public statisticians, their total value would have been little short of \$10,000,000, while employment was furnished in this industry to over 1,000 men.

To all these facts and figures, illustrative of the rapid development of your mining industries in recent years, there is yet to be added the marvellous story of Cobalt, which has already proved itself to be the second Klondyke in the world-wide interest which it has aroused. Your Province is also to be congratulated in possessing in the person of your active Minister of Mines, the Hon. Mr. Cochrane, one who has not only taken

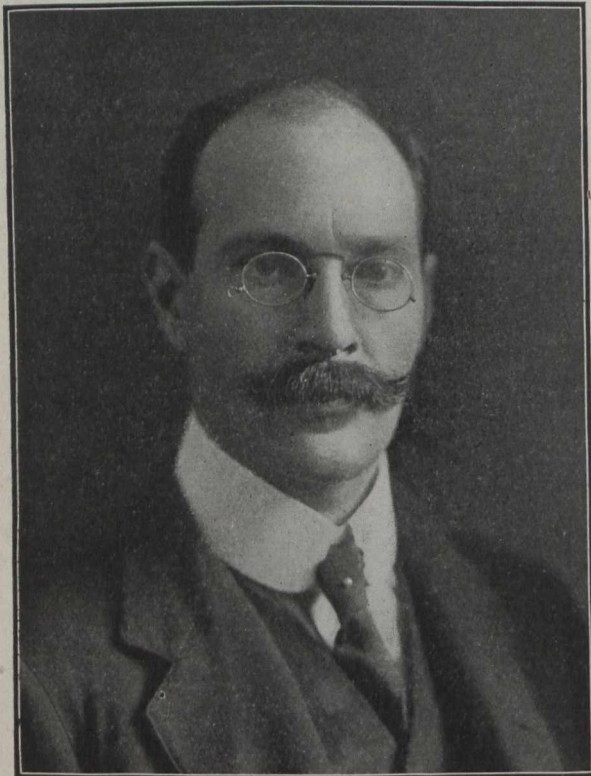
our Province, and communication which, I hope, shall prove valuable to both Provinces.

Last year I remarked on the development in mineral resources that would follow the construction of the Trans-Continental Railway. I am more than ever impressed with the assurance of this fact.

We, in Quebec, are only most anxious to join with you in Ontario, without regard to any political considerations, in assuring the best possible legislation for the interests of the mining industry in general, as well as for those who are practically engaged in it. It is certainly to be hoped that the time is not far distant when we shall have, Canadian smelters treating Cana-

dian ores at home, instead of having to ship these latter to the United States for treatment.

The Institute has already proved its efficiency and its ability to largely assist the miner in performing his work and carrying out his ideas generally. I might add that it is only by constant concerted action of this kind that the miner can feel that from Sydney to the



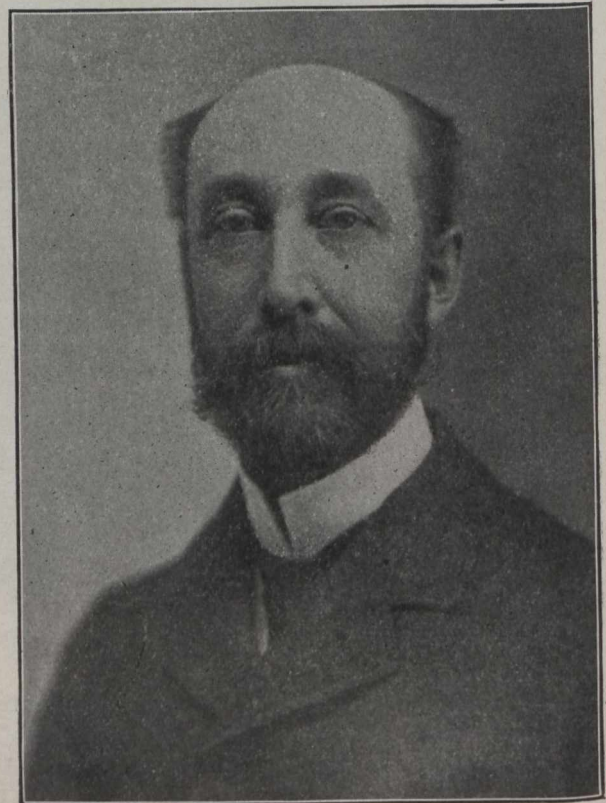
THE SECRETARY—MR. H. MORTIMER-LAMB
Montreal, Que.

Yukon his interests are thoroughly protected, and this unity of purpose and action is bound to secure for the mining men that reasonable legislation which is necessary to the successful carrying out of their work and business. The annual increase in membership shows the popularity of this institution. The modern idea among all professional and scientific classes, civil, mechanical and mining engineers as well, of becoming incorporated for mutual benefit and support, can result only in good. There may be a feeling on the part of some of us that our by-laws, or our methods, or the result of our elections, are not in accord with the ideas of all our members; but our constitution and our by-laws themselves provide any remedy that may be desired in this respect, and after due notice they may be readily amended. Nevertheless, no particular province, nor yet any set of men in the Dominion, should, however, in my opinion, ask for special provisions to meet special circumstances unless with the concerted motion of the whole Institute. It is well that outsiders should know as well as we do that the Institute is not for the benefit of speculators or mining manipulators, but was established, and is maintained, for the advancement and protection of the genuine mining interests all over the country; and, generally to render this work effective and its influence paramount, it is first of all essential, of course, that it should have our loyal adhesion and support as members. Then, while our individual operations, and even the industry as a whole, may have their

respective ups and downs, the Institute, I trust—like Tennyson's Brook—will flow on for ever; and, although Cobalt, contrary to every indication, should see its failure, as Port Arthur did some twenty years ago, the Mining Institute would continue its useful career for future generations of mining men.

Gentlemen, it is scarcely possible to declare that the present meeting in this hotel is opened without a passing reference to the unfortunate circumstances attending our former meeting here. There can be no doubt whatever that the regretted death of our late esteemed secretary—Mr. B. T. A. Bell—upon the very eve of the meeting, placed a damper upon the entire proceedings of the convention of that year, so that it was scarcely possible for the City of Toronto, or the Province of Ontario, of which it is the splendid capital, to have formed from that meeting any fair idea of the importance or the influence of this Institution. We meet again to-day in Toronto, not only as one of the mining centres of the Dominion, but the centre of the Dominion from the mining standpoint.

In declaring this ninth annual meeting of the Canadian Mining Institute open for the despatch of business, it is in no purely formal manner that I express the fervent hope that you are each and all a unit in contributing to its interest and success. The papers that are to be read cannot but prove instructive to every mining man, covering, as they do, everything in our mining interests, from coal to gold. It only remains for me to



THE TREASURER—MR. J. STEVENSON BROWN
Montreal, Que.

thank you, gentlemen, for having honored me with the highest office in your gift, and to ask from you continued confidence and support through the sessions of the present convention.

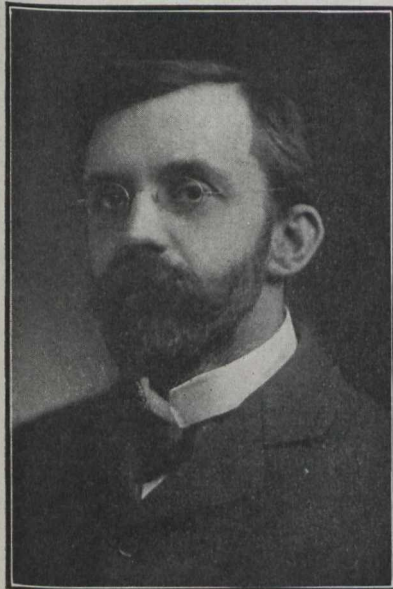
I believe, gentlemen, in conclusion, that in meeting here in Ontario that there are some vital issues

that keenly interest the gentlemen engaged in the mining industry in this Province. It is the duty of this Institute to do all that they can to assist you, and I believe that we come here prepared as an Institute to take up your grievances—whatever they may be—and do all that we possibly can for the best general good of the Institute first, and your interests in general.

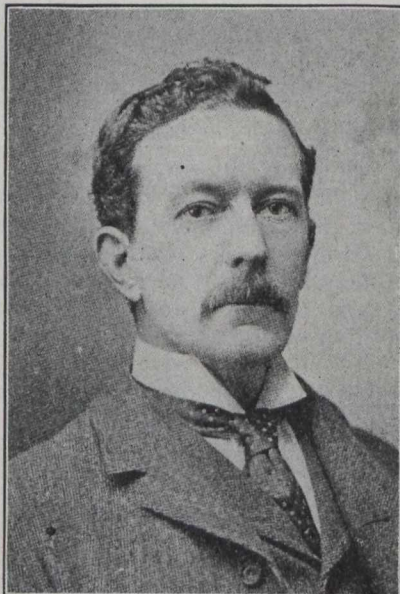
**REPORT OF THE COUNCIL FOR THE YEAR
1906-1907**

MEETINGS.

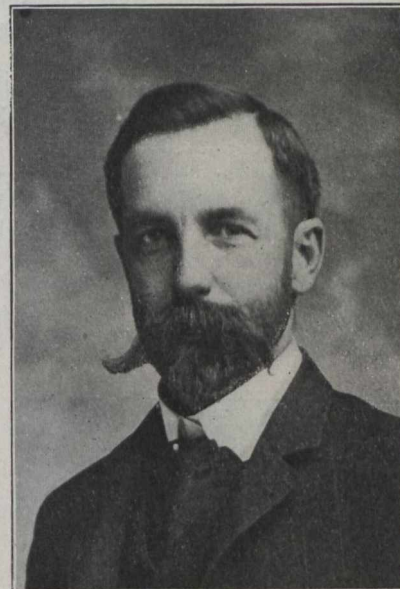
The eighth annual general meeting of the Institute was held at the Chateau Frontenac, in the City of Quebec, on March 7th, 8th and 9th, 1906. The meeting was



VICE-PRESIDENT—MR. J. BONSTALL PORTER,
Professor of Mining, McGill College, Montreal.



VICE-PRESIDENT—MR. W. FLEET ROBERTSON
Prov. Mineralogist of British Columbia, Victoria.

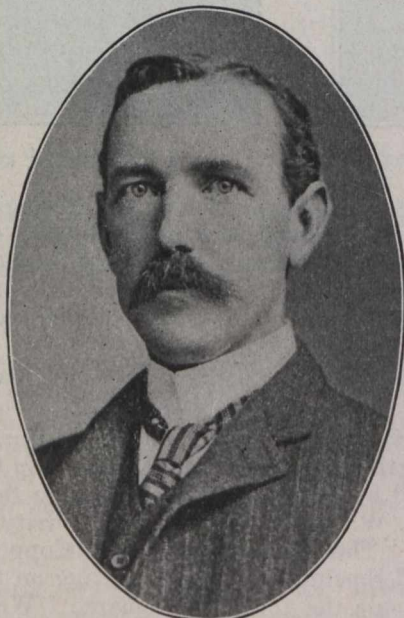


VICE-PRESIDENT—MR. W. G. MILLER,
Provincial Geologist of Ontario, Toronto, Ont.

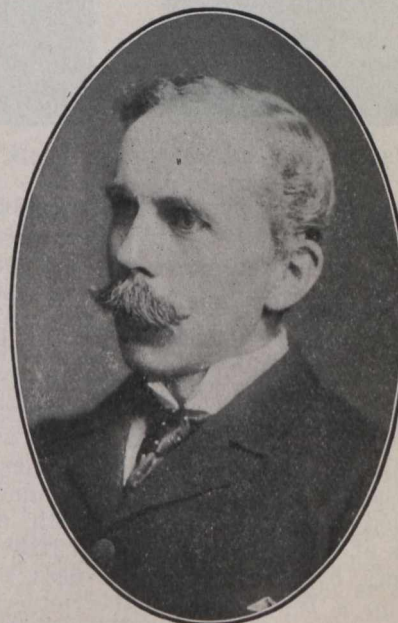
I thank you very much for your kind attention, and, just before starting the regular business of the meeting, I might add that the question of legislation will be taken up this afternoon; the question of legislation as regards the mining tax in Ontario. I hope you will all—those of you particularly interested in it—come here

an unqualified success, and the Council again records its appreciation of the services rendered by Dr. J. Bonsall Porter, to whom, as acting secretary, fell the chief responsibility of organizing and carrying out the arrangements in connection with the proceedings.

During the year meetings of Council were held at



MR. JAS. McEVOY, Mining Geologist,
Crow's Nest Pass Coal Co., Fernie, B. C.



DR. FRANK D. ADAMS,
Logan Prof. of Geology, McGill Univ., Montreal.

and lend us your best efforts, to see if anything can be done to make the Hon. Minister of Mines see things, if possible, from the mining standpoint, which, we believe, will result in the general good of the Province. (Applause.)

headquarters. As provided by par. XXXII. of the by-laws, typewritten copies of the minutes of these meetings have been regularly sent to each individual member of the Council, affording those members residing at a distance and thus precluded from personally

attending, an opportunity of presenting their views on all matters of business coming before the Council. It is hoped that in future full advantage will be taken of this provision, that the Institute may derive the benefit of the advice and active interest of every member elected to serve on its Council.

PUBLICATIONS.

Thirty-four papers were presented at the Quebec meeting, and these, with the discussions thereon, and a report of the proceedings of the meeting, now form Vol. IX. of the Journal of the Institute, which has been issued to members in good standing.

MEMBERSHIP.

It is gratifying to be able to record an important increase of approximately twenty-five per cent. in the membership during the year, which now, including students, for the first time exceeds five hundred names. This may be regarded as indicative of appreciation and recognition on the part of those engaged in the development of our mineral resources, of the useful work this

practical character; and the appointment of that gentleman to the head of the Survey is a matter for congratulation on the part of the mining industry in Canada. Following the appointment of Mr. Low to the Directorship, the Survey was disassociated from the Department of the Interior, and placed under the Ministerial charge of the Hon. Mr. Templeman. Although, as yet, the bill for the establishment of a Department of Mines has not been introduced into Parliament, it is understood that such a measure is now under contemplation, and it is hoped, therefore, that before another year shall have passed the wishes of the mining industry in this important respect will have been realized.

LIBRARY.

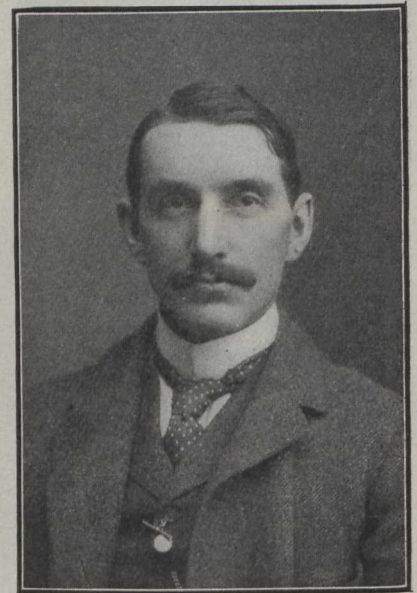
During the year an addition of some fifty volumes was made to the library, and a number of exchanges, including transactions of technical societies, official report and periodicals, covering a period of three years, were bound and added to the shelves. A new catalogue, on the card index system, has also been prepared. The librarian



MR. FRANK B. SMITH, Edmonton, Alta.



MR. R. W. BROCK, Ottawa, Ont.



MR. J. C. GWILLIM, Kingston, Ont.

Institute is attempting to perform in the interests of mining in the Dominion.

DEPUTATIONS.

Pursuant to a resolution unanimously passed at the Quebec meeting, requesting the president to appoint a delegation to wait on the Dominion Government and urge the desirability of the early establishment of a Federal Department of Mines, under the direct supervision of a responsible Minister of the Crown, a deputation, of which the following gentlemen were members, Messrs. Smith, Adams, Porter, Drummond and Brown, proceeded to Ottawa on April 18th, and presented the views of the Institute to Sir Wilfrid Laurier and his colleagues, by whom they were most favorably received. Within a few weeks of this interview, the office of Director of the Geological Survey of Canada, which had remained vacant since the death of the late Dr. George Dawson, C.M.G., was filled by the appointment of Mr. A. P. Low, whose interest in that branch of geological science which deals more particularly with the solution of economic problems, is well known. The work of the Survey during the past year, under Mr. Low's direction, has been of an eminently useful and

desires to thank in particular the Geological Survey of Canada, the British Columbia Bureau of Mines, the Mining Society of Nova Scotia, the Institution of Mining Engineers and the Mining Institute of Scotland for the donation of valuable early editions required to complete the library sets.

STUDENTS' COMPETITIONS AND AWARDS.

After receiving the report of the judges, Messrs. Charles B. Goring and Frederick Hobart, the Council awarded the president's gold medal, for the best paper submitted by a student member during the year, to Mr. Frank G. Wickware, of McGill University, for his thesis entitled "The British Columbia Copper Company's Mine and Smelters." In commenting on this paper, the judges made the following remark: "We would assign first place to Mr. Frank G. Wickware's paper on account of the comprehensiveness, clearness and ability shown in his descriptive treatment, the good literary style, and the judgment and care shown in arranging and preparing the paper. It is orderly and methodical, well illustrated, representing careful and painstaking work, and appears to us to be worthy of special commendation. A strong point is the inclusion of data in relation to

costs of working, which are a critical point in all mining and beneficiating operations. It is also to be considered that the paper relates to a Canadian mining enterprise of importance." It may not be inappropriate to add that, in consequence of the general excellence of this paper, Mr. Wickware was offered, and has accepted, the post of assistant editor to so important a technical periodical as *The Engineering Magazine*, of New York and London.

The Council also awarded three cash prizes of \$25 each, as follows: To Mr. Frank B. Wickware, for the paper mentioned above; to Mr. J. J. Robertson, School of Mining, Kingston, for his paper entitled "Cyanide Tests on Temiskaming Ores," and to Mr. R. P. Cowen, McGill University, for his paper entitled "Number Four Pit, Brayton Domain Collieries, Cumberland, England."

The Council takes pleasure in congratulating the above gentlemen on the very creditable papers they have presented to the Institute.

H. MORTIMER-LAMB,
Secretary.

time he was in charge of the Statistical Department of the Geological Survey.

AMENDMENTS TO THE BY-LAWS.

A number of amendments to the by-laws were then introduced and finally passed, the most important of which provided for the raising of the standard of membership, by creating a new class of associate membership, to which in future those not directly or technically qualified for membership will be admitted. It was also decided to increase the number of council from sixteen to twenty, and a further amendment provided for the abolition of the Nominating Committee, leaving nominations for officers and council to be submitted by individual members.

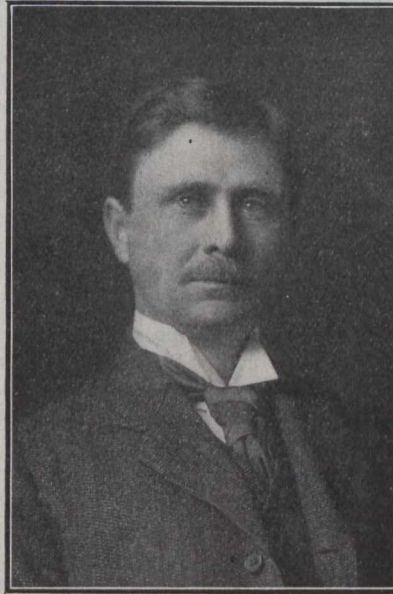
PROPOSED MINES TAXATION IN ONTARIO.

Mr. J. M. Clarke, K.C., then read a paper on "Mining Royalties," which was productive of an interesting discussion in criticism of the bill recently introduced by the Ontario Government, proposing a tax on mines in that province.

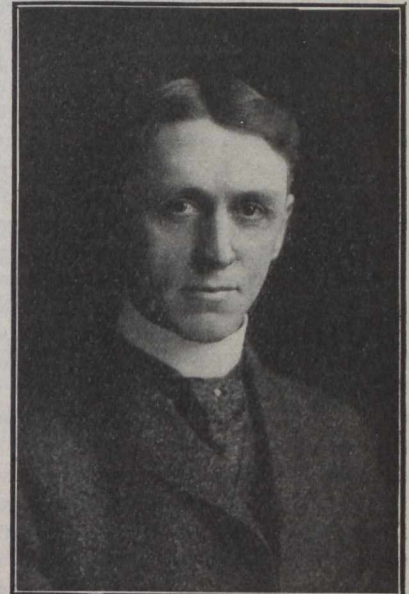
Mr. Clarke pointed out that the bill aimed at taxing mineral areas to which absolute title had previously been granted, and on which the province had pledged itself not to impose royalties.



MR. E. W. GILMAN, Montreal.



MR. H. E. T. HAULTAIN, Craigmont, Ont.



MR. DAVID BROWNE, Copper Cliff, Ont.

The ninth annual meeting of the Canadian Mining Institute was formally declared open by the retiring President, Mr. G. R. Smith, on the morning of March 6, at the King Edward Hotel, Toronto.

WEDNESDAY.

During the morning President Smith delivered a forceful address which is reproduced on page 36.

Reports of the treasurer and secretary were read. Both showed a very encouraging condition of affairs. A balance of \$1,300 remains to the credit of the Institute after all claims are paid, and an increase of over 20% in the membership was recorded.

MINERAL STATISTICS.

Mr. J. McLeish, of the staff of the Mines Section of the Geological Survey of Canada, presented a statement in detail of mineral production in the Dominion for the past year, the estimated value of which were shown to aggregate over eighty million dollars, or an increase of twelve million dollars as compared with the returns for 1905.

In the discussion that followed Mr. E. Coste pointed out that this increase in twelve months represented rather more than the mineral production of Canada some twenty years ago, at which

Mr. Coste added that the incidence of the tax was unjust in many respects, while in the case of the proposed tax on natural gas, the provision for the measurement of gas at the mouth of the well was absurd and impracticable. A Mr. White, representing American capital in Cobalt, having received permission to address the meeting, stated that, in view of the introduction of the measure by the Provincial Government, his principals, who were engaged in legitimate mining and were not company promoters, had decided to withdraw from the field.

It was then moved by Mr. Craig, seconded by Mr. Hardman, and carried, "That the Canadian Mining Institute, in annual meeting assembled, believe that the bill now before the Ontario Legislature, providing for the confiscating of mines, is opposed not only to the mining interests but also to the manufacturing and the agricultural interests of the province, and we as a body respectfully ask the Ontario Government to take time and carefully consider what have been the effects of mining legislation in other countries and in other provinces on such lines as now proposed, before allowing this bill to become law." On motion it was decided that a deputation of fifty gentlemen representing the Institute should wait on the Hon. F. Cochrane, Minister of Mines, to present the above resolution, and Messrs. Clarke, Leonard, Hardman, Hay and the president were deputed

to address the Minister on the subject of the resolution. The meeting, after some further discussion, adjourned to the Parliament Buildings, where the deputation waited on Mr. Cochrane and his colleagues. The Minister invited a full discussion of the bill, and asked that a committee from the Institute meet again with him on the following Friday afternoon to discuss suggested amendments. This invitation was accepted, and, after seeing Mr. Cochrane on Friday, the committee presented the following report:—

REPORT OF COMMITTEE ON MINING TAXATION.

The committee appointed by the Canadian Mining Institute to interview the Hon. the Minister of Mines concerning the bill for the taxation of mines in the Province of Ontario, met the honourable gentleman on Wednesday afternoon, accompanied by a delegation of fifty members of the Institute. On the invitation of Mr. Cochrane, the committee again met in the Minister of Mines' office on Friday at twelve o'clock. There were present at this interview the Premier, Mr. Whitney, the Provincial Secretary, Mr. Hanna, and the Minister of Mines, Mr. Cochrane.

Many paragraphs and features of the bill, together with the principle of the measure, were discussed, especially the objections which were submitted in a series of resolutions adopted by a full meeting of the Institute on Thursday afternoon and which were immediately transmitted to Mr. Cochrane. While the committee adhered firmly to the resolutions passed by the Institute, yet upon the personal assurance of the Minister that he would modify certain clauses to meet objections, which were stated, and upon his statement that some measure for revenue would have to be enacted at this session, and his further assurance that, as Minister of Mines, he would see to it that the execution of the law should be made as little onerous as possible, that he would be willing to support a new bill drafted to meet the views of the mining community of the province, if the same were prepared within a year, the committee decided to leave the matter in the hands of Mr. Cochrane for this year. They pledged themselves to submit to him within twelve months the draft of a new bill, which would be more acceptable to the mining interests of Ontario. This action was taken in consequence of the personal confidence which the representatives of the mining industry in Ontario have in Mr. Cochrane.

WEDNESDAY EVENING.

At 8.30 p.m. Mr. H. H. Stoek, editor of *Mines and Minerals*, of Scranton, Pa., delivered an interesting and instructive address, illustrated by lantern slides, on "Preparation and Mining of Anthracite in Pennsylvania." Mr. Stoek, to whom was accorded a vote of thanks, was followed by Mr. E. Coste, who read a paper on the "New Tilbury Oil Fields."

A very interesting discussion resulted from the reading of a paper by Mr. J. C. Gwillim, of Kingston, on the "Status of the Mining Profession in Canada, in which Dr. Ledoux, Mr. Coste, Dr. Porter, Dr. Goodwin and others took part.

THURSDAY MORNING SESSION.

A very interesting discussion resulted from the reading of a Miller, Provincial Geologist, in explanation of some additions to the map of Cobalt district. Mr. Miller stated that on the occasion of last annual meeting of the Institute in Toronto, three years ago, the Bureau of Mines displayed for the benefit of the members a fine exhibit of Cobalt ores, but that very little notice was taken of it, and it took the public eighteen months to awaken to the fact that the Cobalt district was worthy of attention. In the meanwhile the profits of mining in this small area had already made millionaires of eight or ten men, while some twenty or thirty others had, by legitimate means, amassed fortunes of from \$25,000 to \$300,000. Mr. Miller explained that his map of the district had been drawn to on a scale of 400 feet to the inch, and all the known veins had been drawn to scale. He stated that there were roughly a hundred, probably, productive veins in the district, while others were being constantly uncovered.

THE GEOLOGY OF THE COBALT DISTRICT.

Dr. C. K. Van Hise, president of Wisconsin University, Madison, Wisconsin, then delivered a lengthy and most valuable address on the "Geology of the Cobalt District," of which we print an abstract elsewhere in this issue. The paper was discussed by Mr. Ingall, Mr. Hixon, Mr. Coste, Dr. Bell, Mr. Miller, Mr. Tyrrell, and Mr. Brock. Dr. Bell also read a paper on the Cobalt district, embodying the views contained in his report to the Geological Survey.

In the afternoon Mr. Hiram W. Hixon read a paper on "The Smelting of Cobalt Ores." The following papers were also read: On "The Minerals of Alberta," by Mr. D. B. Dowling; "The Grondal Processes of Concentration," by Mr. P. McN. Bennie; on "Electric Furnaces," by Dr. A. G. Stansfield; "Sir William Logan and the Geological Survey," by Dr. Robt. Bell, and on "Magmatic Waters," by Mr. H. W. Hixon. This last paper created a lively discussion, in which the author found himself pitted in the lists with such doughty scientific champions as Dr. Kemp and Dr. Coleman.

THE ANNUAL DINNER.

Members and the guests of the Institute, including His Honor the Lieutenant-Governor of Ontario; the Hon. Frank Cochrane, Minister of Mines; the Hon. Mr. Hanna, Provincial Secretary; the Mayor of Toronto, Dr. Van Hise, Dr. Kemp, Dr. Chamberlain, Dr. Baylie Willis, Dr. Wm. Campbell, and others, assembled in the "Yellow Room" of the King Edward Hotel at 8 p.m., when a short reception was held. Dinner was served in the banquet hall at 8.30, covers being laid for a hundred and thirty.

The table was very tastefully decorated, and the tables arranged to seat parties of six, exclusive of the head table, reserved for the guests of honor, at which the president, Mr. G. R. Smith, presided. Seated on his right was His Honor the Lieutenant-Governor, and on his left the Hon. Frank Cochrane.

The toasts, "The King," and "The President of the United States," having been received with musical honors, the Hon. W. Mortimer Clark, Lieutenant-Governor of the Province, responded in an able and witty speech on behalf of the Dominion and Provincial Governments. The speaker, in passing, stated that he had not had much experience in mining, although he had essayed some experiments, and in consequence had made several very "permanent investments." Mr. Cochrane and Mr. Hanna also responded to the same toast, and the new Canadian National Anthem, the music of which was composed by Dr. Albert Ham, was sung by a trio of professional singers and greatly applauded. "The Mining Industry" was responded to by Mr. J. E. Hardman and Dr. Kemp; "Sister Societies," by Dr. Ledoux, past president of the American Institute of Mining, Mr. R. W. Leonard, representing the Canadian Society of Civil Engineers, and Mr. Corbett, representing the Mining Society of Nova Scotia; "Our Guests," by Dr. Van Hise, Dr. Chamberlain and Dr. Willis; and "The Press," by Mr. Frederick Hobart, associate editor of *The Engineering and Mining Journal* of New York; Mr. H. H. Stoek, editor of *Mines and Minerals*, Scranton, Pa., and Mr. J. C. Murray, editor of *THE CANADIAN MINING JOURNAL*. At midnight the evening was (officially) brought to a close with the singing of "Auld Lang Syne" and the National Anthem. After which, however, Mr. G. R. Smith gave a lucid and thoughtful address on the text, "Why Are We Here." His efforts were ably supported by a distinguished guest of the evening.

FRIDAY MORNING SESSION.

The session opened at 10.30 a.m., when the president announced the result of the election of officers and council for the year 1907, as follows:—

President—Mr. Frederick Keffer, Greenwood, B.C.
 Vice-Presidents—Mr. W. G. Miller, Toronto, Ont.; Mr. W. Fleet Robertson, Victoria, B.C.; Dr. J. Bonsall Porter, Montreal.
 Secretary—Mr. H. Mortimer-Lamb, Montreal.
 Treasurer—Mr. J. Stevenson Brown, Montreal.

Council—Mr. E. W. Gilman, Montreal; Mr. Jas. McEvoy, Fernie, B.C.; Mr. Frank B. Smith, Edmonton, Alta.; Mr. R. W. Brock, Ottawa, Ont.; Mr. J. C. Gwillim, Kingston, Ont.; Dr. F. D. Adams, Montreal; Mr. H. E. T. Haultain, Craigmont, Ont.; Mr. D. H. Browne, Copper Cliff, Ont.

On motion of the secretary, Mr. John A. Dresser, M.A., of Montreal, was elected to fill the vacancy on the council occasioned by the election of Dr. Porter as a vice-president.

The following papers were then read:—

“On the Microscopic Examination of Nickeliferous Pyrrhotite,” by Dr. Wm. Campbell, of New York.

“The Marble Bay Copper Deposit, Texada Island, B.C.,” by Mr. O. E. Leroy, of Ottawa.

“On the Progress of British Columbia’s Mineral Production, 1897-1906,” by Mr. G. Jacobs, editor of the *British Columbia Mining Record*, Victoria, B.C.

“The Geology of the Franklin District Ore Deposits, B.C.,” by Mr. R. W. Brock, of Kingston, Ont.

AFTERNOON SESSION.

The secretary, having read a letter from the Institution of Mining and Metallurgy, on the subject of standardization, the following committee, Dr. Porter, Mr. Haultain and Mr. Willmott, were appointed to convey the views of the Institute on the subject to the Institution of Mining and Metallurgy.

Dr. Ledoux then gave a short address on the “Richness of Cobalt Ores,” which we hope to publish in a future issue.

Papers were read, by Dr. Kemp on “Some New Points in the Geology of Copper Ores,” by Wm. Fritz Cirkel on “The Mineral Resources of the Province of Quebec,” and by Mr. H. J. Carnegie Williams on “The History of the Bruce Mines, Ontario,” and the meeting closed with a vote of thanks to the retiring president.

THE C. M. I.—A BRIEF HISTORICAL SKETCH

BY THE SECRETARY, H. MORTIMER-LAMB.

In writing an account of the history of the Canadian Mining Institute, it is not quite easy to determine where to begin. Officially the Institute, as at present constituted, is nine years old, dating its birth from its incorporation by charter, granted by the Dominion Government in the year 1898. But the germ of the idea was conceived long before then in the active brain of a man, to whose strong personality, energy and public-spiritedness, we as an organization owe so much.

Going back to the old records, we find that no successful effort had been made to secure a general conference of those engaged in mining in the Province of Quebec until 1891, when B. T. A. Bell took the matter in hand and organized the General Mining Association of that province. Again, in 1892, he was the prime mover in the organization of the Mining Society of Nova Scotia, of which he became honorary secretary, and in 1894 he organized the Ontario Mining Society. But Bell was not satisfied with these efforts. He was an ardent champion of national unity, and he found strong support in such men as G. E. Drummond, Hardman, Fergie, and others, in the promotion of his scheme for federating the several provincial organizations and forming one representative body of men engaged in the business of mining in Canada. The plan was first mooted in 1893, and agreed to by the three provincial societies at a united meeting of members at Sydney, Cape Breton, in July, 1894. But it was not until 1896 that the Federated Canadian Mining Institute came into existence, with that staunch veteran, Major R. G. Leckie, who is still the youngest of us all, as the first chairman. The objects of the Federated Institute, as set forth in the constitution, were:

(a) The publication in one volume of the papers and proceedings of the several organizations in the Federation.

(b) Action upon all matters affecting or relating to the mineral industries of Canada.

The Federation continued in existence for two years, serving a useful purpose, but with the growth of the industry it was decided in 1898 that the time was opportune for a re-organization on a more comprehensive scale.

The committee added: “We cannot consider that the Federation has successfully accomplished the purpose of its foundation, in that it has brought together for their mutual benefit the different members of the different provincial organizations, and has created and extended a knowledge of our resources, methods and different personalities. . . Recognizing, however, that Canada is but just beginning her career as a mineral country, and that our position is much more permanent to-day than ever it has been, we cannot be blind to the necessity of providing more funds, for the proper publication of our transactions, than the Federation possesses under its present form of organization.”

So the affairs of the Federated Institute were wound up, and from its ashes, Phoenix-like, arose the Canadian Mining Institute, with an initial membership of somewhere in the neighborhood of two hundred representative men. The new charter stated that the association had been founded for the following commendable purposes:—

“First, to promote the arts and sciences connected with the economical production of valuable minerals and metals, by means of meetings for the reading and discussion of technical papers, and the subsequent distribution of such information as may be gained through the medium of publications. Second, the establishment of a central reference library, and a headquarters for the purpose of this organization. Third, to take concerted action upon such matters as affect the mining and metallurgical industries of the Dominion of Canada. Fourth, to encourage and promote these industries by lawful and honorable means.”

The record of the work done in the past few years, the high standard of excellence of many of the papers contributed to the transactions of the Institute, and the influence the organization has been able to exert in opposing both Federal and Provincial legislation inimical to the interests of the mining industry, stands for itself.

A word, however, in conclusion, of the men who have helped to make the Institute what it is. After Bell, no one man has worked harder or to better purpose in the interests of the organization than its first president, John E. Hardman. Not only was he during his term of office (1898 and 1899) the ideal presiding officer, impartial, firm, resourceful and eloquent; but for the many years he has served on the council he has ever been ready to sacrifice his private interests to the good of the Society. Whether it was in acting gratuitously as the custodian of the library, serving on committees and deputations, or undertaking secretarial work when it became necessary for some one to act, his services might always be depended on.

But then the Institute has been extraordinarily fortunate in its presidents. I believe it is recorded that Mr. Fergie, during his two years of office, never missed a council meeting, and, when it is remembered that the journey from Nova Scotia to Montreal is somewhere in the vicinity of a thousand miles, this singular instance of devotion and attention to a duty is probably unique. Both Mr. Coste and Mr. G. R. Smith have also done yeoman’s service, the former acting as president during a critical time in the history of the Institute when, just before the annual meeting of 1904, Mr. Bell met his death in so tragic a manner. As to Mr. Smith, we have hardly yet accustomed ourselves to regard him in the past tense. He has been the life and soul of the last two annual meetings, and under his presidency the Institute has prospered and grown in influence and usefulness.

The Institute is, meanwhile, to be congratulated in the election of Mr. Frederic Keffer as president for the current year. He is an engineer of very eminent attainments, and enjoys the esteem and respect of all who have the privilege of his acquaintance.

THE GEOLOGY OF THE COBALT DISTRICT

ABSTRACT OF PAPER READ AT MEETING OF CANADIAN MINING INSTITUTE, BY
PRESIDENT C. R. VAN HISE, MADISON UNIVERSITY, WISCONSIN.

I had thought of talking, not on the geology of Cobalt, but rather on the ore deposits of that district. The foundations of everything I shall say have been laid by Professor Miller. I myself have learned to appreciate very deeply the accuracy, carefulness, faithfulness and correctness of the geologic work that has been done in the Cobalt area. For many years, however, I have been interested in the general principles concerning the deposition of ores, and from that point of view I have approached this district. What does this district afford in confirmation of any variation from the principles of ore deposition, which have been the subject of study by so many geologists for so many years? This origin, it seems to me, is one which illustrates broadly and well certain principles of two concentrations.

In common with many other geologists, it has been a question with me as to whether or not ore depositions are usually produced by one or two or several concentrations; and very few of the districts which I have visited will exhibit more than one concentration. The history of the ore deposit is not simple, but is usually very complex. One geologist will say that certain ore depositions are produced altogether by magmatic segregation; another, that they are due to ordinary vein action through circulating waters. Others will say that they are due to atmospheric waters.

In almost all cases of dispute, when I have been so fortunate as to go into the district, I have found the story to be a complex one; that each man has had a part of the truth. So these different views are all partial truths.

I have been in Cobalt district only a short time, and could have done nothing, except for the foundation work which I have mentioned; but very early I became convinced that this was an origin in which there had been two periods of concentration—a concentration under deep seismic conditions, free from oxygen, a deep-seated circulation (I know nothing as to whether the waters were atmospheric or magmatic, or partly one and partly the other) in which the oxides and arsenides of cobalt and nickel were deposited in large measure; and that since that time there has been a secondary concentration, which was the result of surface waters descending or travelling laterally, connected in a way with the surface and producing the effect of oxidizing waters. The ore deposits, to be adequately explained, must be the result of this deep-seated circulation producing ores in one form, and of a modifying surface circulation.

The first year I was in the district both Professor Miller and I were inclined to believe that the native silver came in connection with late secondary fracture and surface circulation. It appeared perfectly clear that in many of the veins the cobalt minerals were early products of the deep-seated concentration. Then there was a lateral fracture, followed by the injection of silver-bearing solutions, and as a result of the reducing action of the cobalt minerals the metallic silver was thrown down.

I would by no means assert that this is the case with all the metallic minerals. But this suggestion explains many curious things, which you will see when you visit this district. A vein following along the strike shows extraordinary variations in richness, both vertically and laterally. If all the minerals came in at the same time, why should not the silver be somewhat evenly disseminated? When you examine the deposits closely you find that frequently those richer deposits are in places where the veins have been shattered comparatively later, and the silver-bearing solutions have been reduced by contact with the cobalt minerals. This is exactly analogous to the deposition of gold in the San Juan district in Kansas and Southwestern Colorado.

Here there were high-grade values at the surface, but deeper the ores became very lean, although the veins were persistent. But in the Smuggler-Union mine, and the Camp Bird, and others, you find a zone of shattering with very rich streaks of gold.

Now the question arises, to what extent are the Cobalt deposits the result of one segregation, and to what extent the result of two?

I am myself, at the present moment, wholly unable to answer that question. It will be one of the problems which the Canadian geologists will work out. But one thing is certain—that those extremely rich superficial depositions of a few feet in thickness, which are connected directly with the weathering, have been produced by two concentrations, one being under deep-seated conditions, when the atmospheric waters were not present, and the other occurring along with erosion. We must remember that in the past these veins went up into the atmosphere to an unknown extent. The veins have been eroded profoundly. Take the veins at the level of ground circulation. In the case of the argentite, it will be oxidized by the atmospheric waters to silver sulphate, which is rapidly soluble. It will be picked up by these waters and carried down into the veins where, coming in contact with the cobalt minerals, the silver will be precipitated in irregular nuggets. Some of these nuggets have reached a depth in the vein. Many have been carried away by subsequent erosion, in fact a vastly greater number than have been found must have been scattered abroad.

Thus this extremely rich upper belt which is so characteristic of Cobalt is unquestionably the result of two concentrations. But most of the mines depend not upon this superficial zone but upon a horizon which is down below. To what extent has this deeper horizon been the result of a single concentration under deep-seated conditions and, later, of concentration under surface conditions? I am unable to give a definite answer. I am, however, willing to express an opinion. I believe that the secondary concentration, even for this main belt, has had important additions during this secondary concentration. Whether its main richness was thus produced is something for the future to decide.

A very important question now comes up as to the relation of the ores to the diabase. My judgment coincides with that of Professor Miller, that probably the diabase is the source of the ore. The reason for this belief is that those Keewatin and Huronian rocks seem to be in all respects similar to that great double series of formations from Port Arthur to Cobalt. In other words, there are 500 miles of distance through which these Keewatin rocks occur, and conglomerates similar to the Cobalt conglomerates.

Then if the source of the ore was either the conglomerates or the Keewatin, why have not other districts been found in this great area? Doubtless other districts will be found; but this great region has been worked over so thoroughly in such areas as the Lake of the Woods and others, as to make it extremely improbable that the exceptional conditions are associated with the ancient igneous rocks, the ancient floor which was associated with the Huronian conglomerates and slates. Naturally, you associate the exceptional conditions with the sheet of diabase.

But it may be said also, the diabase, as an intrusive rock, occurs all the way from Port Arthur to farther east than this, and is all somewhat similar to this. This is true, but it does not at all follow that when they came up from the reservoirs of this area some exceptional materials were not added. This was true of the Sudbury deposition. There were here exceptional additions after the igneous rocks. And so I believe that the

source of the cobalt nickel and silver mineral is the diabase. How is it that the veins are in the diabase and partly in the diabase and the conglomerate, and also in the Keewatin? Before answering this last question, let us glance at the distribution. Is this diabase a comparatively thin layer separating other layers, or is it great stack that goes down vertically? It seems to me that we have almost conclusive evidence on this point beyond the evidence that Professor Miller has given. If this diabase were a great round mass like this, going down and becoming bigger, then you would have such conditions as you have west of Lake Superior. These layers would be strained and turned back on one another. This is not the case here. There is a gentle series of rolls and folds. There has been no straining. Therefore, Professor Miller must be right in saying that this is a flat sheet. But he has not used the argument, which to me is even more conclusive than the observed facts. It takes hundreds of years for a great sheet like that to come into this region, and that great sheet first cooled along the contacts. While the outer parts solidified, the larger part of the mass was still liquid. Conditions were now favorable for emanations to come from this rock; for fractures to form consequent upon the gentle folding and lifting of the cooling mass. Solutions formed in the cooler parts of the diabase would be set free by these motions, and would carry their cobalt and silver minerals to the fissures and cracks formed by contact with the conglomerate and Keewatin. The fact that the larger mines in the Diabase are close to the conglomerates and slates, confirms this hypothesis. Some mines are farther away; but there is every reason to believe that the diabase did lap over to the west and was eroded away.

What part did the Keewatin play? It seems to me that the Keewatin, with its great abundance of the gangue mineral calcite, which does not occur in the diabase, provided the precipitating agents, and that the source of the ore was the diabase.

If this is true, you have a still further reason for the association of the ore depositions with this wider belt. The men of the district know empirically that they need not go off in the centre of the diabase. They know that the depositions have been found within reasonable distance of the diabase. But the conclusion must not be carried too far. There are possibilities where you find only conglomerate or Keewatin. Diabase may have been there as a capping material and may have been wholly removed by erosion. But where you get all the conditions together, there is the most favorable place to work.

One further point is important. This deep segregation occurred when the diabase was over the rocks. The circulation, the deposition of material was in the conglomerate, in the Keewatin, and in the lower part of the diabase. There may have been depositions over it, but the main depositions were under it. It follows that it is the legitimate task of exploration to follow this horizon of ore-bearing material down under the diabase.

If it does turn out that this is a legitimate horizon for work, then we shall find out what effect the primary concentration and what the secondary has accomplished. What the results of that comparison will be the future only can tell.

Therefore, in conclusion, I may say that I believe the ore depositions of the Cobalt district to have been produced, not by a single concentration, but two concentrations, one of them under deep-seated conditions, the course of the ore being the diabase, the precipitating agent being probably in the conglomerate. This secondary enrichment has certainly been an important factor in producing such extremely rich superficial films.

It may have been an important factor throughout the entire horizon which is at present being mined. How important a factor it is, it is yet too early to say; but the results adduced, partly from scientific boring, and partly from studying the genesis of the ore, give a rational explanation of the methods of exploration which have been empirically worked out within the Cobalt district.

STATISTICS AND RETURNS

Cobalt shipments for the week ending March 2nd, 1907:—Nipissing shipped 148,470 lbs. to New York. O'Brien shipped 65,500 lbs. to Perth Amboy, N.Y.; 64,630 lbs. to Copper Cliff; 64,480 lbs. to Perth Amboy, N.Y. La Rose shipped 57,480 lbs. to New York. Silver Queen shipped 54,670 lbs. to Copper Cliff. Buffalo shipped 60,000 lbs. to Perth Amboy. Green-Meehan shipped 63,380 lbs. to Copper Cliff.

Mineral production of Ontario for 1906:—

Metallic: Gold, 3,519 ounces, valued at \$59,274; silver, 5,357,830 ounces, \$3,543,089; cobalt, 312 tons, \$30,819; nickel, 10,932 tons, \$3,836,419; copper, 5,940 tons, \$998,548; lead, \$93,500; iron ore, 128,099 tons, \$301,032; pig iron, 275,558, \$4,554,247; zinc ore, 400, \$6,000; total, \$13,422,928.

Less the value of Ontario iron ore smelted into pig iron (101,569 tons), \$243,766. Net metallic production, \$13,179,162.

Non-metallic:—Arsenic, 1,298 tons; brick, common, number, 300,000,000, \$2,157,000; tile drain, number, 17,700,000, \$252,500; brick, pressed, number, 39,860,000, \$337,795; brick, paving, number, 3,000,000, \$45,000; building and crushed stone, \$660,000; calcium carbide, 2,626 tons, \$162,780; Portland cement, 1,698,815 barrels, \$2,381,014; cement, natural rock, 8,453 barrels, \$6,000; corundum, 2,914 tons, \$262,448; feldspar, 20,373 tons, \$43,849; graphite, 1,772 tons, \$15,000; gypsum, 3,265 tons, \$6,605; iron pyrites, 11,095 tons, \$40,583; lime, 2,885,000 bushels, \$496,785; mica, 355 tons, \$69,041; natural gas, \$533,446; peat fuel, 300 tons, \$900; petroleum, 19,928,322 imperial gallons, \$761,546; pottery, \$65,000; quartz, 3,856 tons, \$3,586; salt, 50,414 tons, \$367,738; sewer pipe, \$365,000; sodalite, 200 cubic feet, \$6,000; talc, 1,235 tons, \$3,030. Total non-metallic production, \$9,042,646; add net metallic do., \$13,179,162; total, \$22,221,808.

The total combined production for 1905, which was the previous highest record, was \$17,854,296.

The output of the mines of Cobalt during the year was as follows:—Silver, 5,357,830 ounces, valued at \$3,543,089; cobalt, 312 tons, \$30,819; nickel, 156 tons; arsenic, 1,558 tons. Total value, \$3,573,908.

Up to the end of 1906 the Cobalt camp produced 8,016,061 ounces of silver, worth \$5,015,479, and 446 tons of cobalt, 245 tons of nickel and 1,919 tons of arsenic, valued at \$150,779, \$13,467 and \$3,596 respectively. The last three constituents bring at present little or no return to the mine owners.

Summary of the minera production of Canada in 1906 (subject to revision):—

Metallic:—Copper, 57,029,231 lbs., valued at \$10,994,095; gold (Yukon), \$5,600,000; all other, \$6,423,932, \$12,023,932; iron ore (exports), 74,778 tons, valued at \$149,177; *pig iron from Canadian ore, 104,660 tons, valued at \$1,724,400; lead, 54,200,000 lbs., valued at \$3,066,094; nickel, 21,490,955 lbs., valued at \$8,948,834; silver, 8,568,655 ounces, valued at \$5,723,097; cobalt, zinc and other metallic products, \$350,000. Total metallic, \$42,979,629.

Non-Metallic:—Asbestos, short tons, 59,283, valued at \$1,970,878; asbestic, short tons, 20,127, valued at \$17,230; hromite, short tons, 8,750, valued at \$92,100; coal, short tons, 9,916,177, valued at \$19,945,032; peat, short tons, 250, valued at \$750; corundum, short tons, 2,274, valued at \$204,973; feldspar, short tons, 15,873, valued at \$38,740; graphite, short tons, 447, valued at 18,780; grindstones, short tons, 5,545, valued at \$61,624; gypsum, short tons, 417,755, valued at \$591,828; limestone for flux in iron furnaces, short tons, 366,015, valued at \$268,632; Manganese ore (exports), short tons, 93, valued at \$925; mica (exports), short tons, 913, valued at \$581,919; mineral pigments: barytes, short tons, 4,000, valued at \$12,000, ochres, short tons, 6,837, valued at \$36,955; mineral water, valued at \$100,000; natural gas, valued at \$528,868; petroleum, barrels, 569,753, valued at \$761,760; pyrites, tons, 39,611, valued at \$157,438; salt, tons, 76,387, valued at \$327,150; talc, tons, 1,234, valued at \$3,030.

NEW DISCOVERIES IN NORTHERN QUEBEC.

By J. OBALSKI, M.E., Director of Mines, Quebec.

(Toronto Meeting Canadian Mining Institute, 1907.)

Since last summer a number of prospectors have been in the field exploring the Chibogomo district, the valley of the Bell river, and the north of Pontiac county. In many cases the parties were formed under the auspices of small syndicates, the expense of travelling in these remote regions being considerable. In consequence of these investigations, rather more is now known concerning the mineral potentialities of these areas, and this knowledge is strongly corroborative of the opinions previously expressed by geologists in charge of reconnaissance surveys. The writer last year personally visited the regions between the Hanicanaw River and Lake Abitibi. Below is summarized the more important discoveries made and the geological features in connection therewith.

In the Chibogomo district some work has been done on the big quartz vein of Portage Island, showing the continuity of the vein at depth and its larger mineralization in the form of chalcopyrite. This development includes a number of open cuts on the vein, covering a distance of about 1,000 feet, and the sinking of a shaft to a depth of 35 feet. From tests made, the value in gold and silver appears to be greater than previously supposed. In the northwest section of McKenzie Bay, new discoveries of asbestos are reported, while northwest of Island Bay a large occurrence of magnetic iron has been discovered. Some large bodies of pyrrhotite carrying high copper values have, moreover, been found northwest of Lake Dore; assays of specimens of this ore have also yielded as high a return as an ounce to the ton.

Northeast of Lake Assinibastot, and southwest of Chibogomo river, cobalt bloom was recently discovered, but too late in the season for the significance of the find to be ascertained. The discovery, however, is seemingly confirmatory of opinions expressed by Mr. A. P. Low and Mr. J. E. Hardman, regarding the similarity of the geological formations here to that of the Cobalt area. It is probable that the district will be well prospected during the coming summer, and other important discoveries will doubtless be made. Meanwhile a good winter trail is now completed from Lake St. John to Chibogomo.

In the north of Pontiac, the writer has explored from the Baie des Guize following the Ottawa and Kinonge rivers, Lake Kewagama, Lake Askikwaj and northward down the Hanicanaw river 20 miles north of the proposed route of the Transcontinental Railway, and thence to Lake Abitibi, White Fish river, and south to the Baie des Guize. Outcrops of Laurentian gneiss occur south of Askikwaj Lake, north of Kewagama Lake, north of Long Bay of Kinonje river, and south of the height of land on the shore of Lake Opasatica. However, the area south of that line is, of course, not all Laurentian, bands of Huronian being found in several places, as shown in Dr. A. E. Barlow's map of 1899. The country crossed by the Transcontinental Railway is covered by a thick layer of clay, but shows in places outcrops of rocks, undoubtedly of Huronian age.

The northeast shore of Lake Kewagama is Huronian, as is, too, the district around Askikwaj lake. Descending the Hanicanaw river the same rocks outcrop for some distance; but further down the surface is covered by clay, with occasional outcrops of rocks. The exposures of rock down the river for the distance travelled of forty miles, and also along the route of the Transcontinental Railway for twenty-five miles, were very few. Nevertheless, the rock in sight is Huronian, being diorite, serpentine, schist, and a granite similar to that found on the height of land, near Lake Opasatica. It is reported that chalcopyrite has been found on the shore of the Hanicanaw river, below the Transcontinental Line.

In the serpentine above mentioned the writer has observed small stringers of asbestos. On the southern slope of the height of land some molybdenite occurs, and it is reported that another deposit has been found in the big peninsula of the Lake Kewagama.

In a more westerly direction, the country is rocky and less difficult to prospect, and no important discoveries have been made, except in the vicinity of Opasatica lake. To the northeast of this lake, not far from the height of land, a very remarkable piece of quartz, showing abundant visible coarse gold, was picked up, and exploration since has apparently resulted in the discovery of gold-bearing quartz in place. Two blocks of land have been purchased from the Quebec Government in that section, of which one by the King of the North Gold Mines Company, recently organized to develop the property. The writer visited the district in July last, and, although he did not see any visible gold in the quartz, he obtained good colors by panning the debris in the vicinity of the deposit.

To the south of Lake Abitibi, and close to the shore, a guide of the party found some rock containing gold, and the fact was ascertained that rock of the same character, also showing gold, was here *in situ*.

Some indications of chalcopyrite have also been found close to the boundary line, not far from the 35th mile.

A number of lots have been prospected in the surveyed townships near Temiskaming lake, and a large variety of minerals found there, including galena, iron pyrites, copper pyrites containing some gold, cobalt bloom, and iron; one undertaking, the Jessie Fraser Mining Company, purchased a block of land in Fabre township, on which a small steam plant has been installed. The geological formation of these townships appears to be a succession of bands of Huronian and Laurentian, not yet accurately determined.

On the Bell river some prospecting has been done, but no new discoveries of importance are reported.

Last season the Geological Survey explored from Lake Abitibi Dr. A. E. Barlow also reports on the geology of the eastern part towards the east, following the surveyed lines of the Transcontinental Railway. Mr. W. J. Wilson gives a summary report of this exploration in the last publication of the Geological Survey. The occurrence here of minerals of economic value.

MINING IN THE YUKON

By DR. ALFRED THOMPSON, M.P.

The Yukon Territory has produced in the last ten years, according to official reports, over 120 millions in gold bullion. By far the greater part of this vast amount came from what is known as the Klondyke district, and experts who have examined the gravel deposits and measured the yardage, tell us that there still exists about 100 millions in the gravels in this district alone.

Geologists tell us that a very large portion of the Yukon Territory is auriferous, and a comparison of the Klondyke district with the total area of the Territory would be like a postage stamp on an ordinary envelope.

The output per year has gradually fallen from twenty-two millions in 1900 to some six millions in 1906. The reason for this gradual decline is because of the great expense in mining the gold by the methods used.

The methods comprise sinking shafts, driving tunnels, thawing of the ground by wood fires or steam, pumping water, etc., and could be only used profitably on the richest ground. As this rich ground became exhausted the output declined, not because the gold was all taken, but because the method of mining made it impossible to work at a profit the lower grade gravels.

and claims that, under the old regime, were almost valueless, have During the past year a great change has come over the industry, to-day not only a value but a market. This has been brought about by the introduction of outside capital, in the form of dredges, to mine the valleys, and ditches bringing in water, to mine the hills.

Dredging, although only in its infancy in the Yukon, is assuming the proportions of a vast industry, and in a very few years will send the annual output again up to the twenty million mark.

The modern dredge as used in the Yukon is a work of art, and is the legitimate heir of all the improvements in dredging, with a few specialities for the Yukon. It is self-contained, requires only a small amount of water, is driven by electricity, works night and day, and saves a larger percentage of gold than any other method ever used in the Yukon.

These dredges under the most favorable conditions can wash gravel at a cost of from 12 to 15 cents per cubic yard, and, according to the size and number of digging buckets, will handle from 1,000 to 4,000 cubic yards per day of twenty-four hours.

There are ready for work, or in course of construction, seven dredges within a radius of twelve miles of Dawson. In the spring of 1905 there was only one. If all arrive that are ordered, there will be twenty in the same district in 1908, and this is only the beginning of a great fleet of these gold mining leviathans, which will in a few years be overturning the gravels of the famous Klondyke and its tributaries.

Rock mining for silver and copper is becoming an important industry in the southern end of the Territory, and, as far as it is possible to judge, the future of the Yukon is assured.

THE BRUCE MINES, ONTARIO, 1846-1906

BY H. J. CARNEGIE WILLIAMS, Bruce Mines, Ont.

(Toronto Meeting Canadian Mining Institute, March, 1907.)

This history of Bruce Mines may, the writer believes, prove of interest, not only on account of the property's value, but because of its comparative antiquity. It is sixty years ago since the original locator, a Mr. Keating, who was connected with H. B. M. Indian Department, was shown by Indians the copper deposits of Copper Bay and Bruce, the latter being so named in honor of Lord Elgin, one of Canada's distinguished Governor-Generals.

In the meantime the Montreal Mining Company had been formed, and an expedition, in charge of Mr. Forrest Sheppard, left Montreal in May, 1846. Mr. Sheppard selected eighteen tracts or locations, each one containing ten square miles. The price paid was, according to Mr. E. B. Borron, £150, Halifax currency, for each location, and 20 cents an acre. On a re-examination of these properties the directors became dissatisfied, and blamed Mr. Sheppard; although, in fairness to him, it should be stated that one of the locations covered the famous Silver Islet.

By the advice of Captain Roberts the Montreal Company purchased the Bruce Mines location for £40,000, Halifax currency, and concentrated all their efforts in opening up the Bruce section on the Cuthbertson location. In 1848 a small party, under Mr. Harris, examined the location adjoining to the west, and known by the name of Huron Copper Bay, on the Keating location. They appear to have done a little work, sinking a shaft within a hundred yards of Lake Hpron. The lode here is small, but of good quality. They also discovered and reported on two other lodges further inland, one of which has been re-discovered this year; whilst another discovery is attracting a great deal of attention on account of the value of the ore disclosed and the width of the vein. It is curious to note that apparently no attention had been paid to these discoveries since 1848.

Meanwhile, in the fall of 1848, the first engine house was erected and machinery installed. Unfortunately, the severity of the climate was not allowed for in the construction of the building, and, in consequence, frost got in the stonework, and when the machinery was set in motion it collapsed.

In this year the late Sir William Logan made a very exhaustive examination, and reported very favorably on the property. In 1849 the small settlement consisted of 77 miners, 65 laborers, 4 boys, 11 blacksmiths, carpenters and other artisans, 2 mining captains, 1 engineer, 2 clerks, and 1 superintendent, giving a population, including the families of the workmen, of about 250 souls. Cholera caused several deaths and delayed the erection of machinery, so that it was not until the summer of 1850 that any returns could be made.

The fact was early appreciated that the keynote of success was the smelting of the ore on the spot, and with this in mind the president of the company, the late Hon. James Ferrier, brought out from Wales a copper refiner and three furnace men. This first attempt, unfortunately, proved a failure, and the smelting

works were destroyed by fire. The slag was, in later years, sorted over and the richer portion shipped to England. Assays made by the writer from materials remaining show over 2 per cent. of copper. Ferrier's name is attached to the deepest shaft on this section of the property. The shaft is presumably three hundred feet in depth only, as a record exists of drifting operations east on the lode, in 1868, at the 50 fathom level. (See Plate I showing width of lode at eastern end.)

The dressing operations seem to have been very crude. Cornish rolls, break staff jigs, and concave buddles appear to have been used. Evidently the crushing was not carried far enough, and it is highly probable that they lost three-fifths of the ore contents. At any rate, the results obtained were so different from the estimates, that in 1851 all the officers resigned or were dismissed. In 1852, Mr. E. B. Borron took charge and introduced the tribute system, the men being paid £5 a ton on ore dressed to 15 per cent. and a bonus, varying in price according to market fluctuations, of seven shillings and sixpence per unit. As the ore was dressed to 20 per cent., this would mean £6 17s. 6d. per ton of 21 cwts. A small dividend was declared in 1853, followed by a larger one in 1854. In the latter year the misfortune occurred of the loss of the company's steamer, with nearly all the materials and machinery required for mining and ore dressing operation during the winter. There being no other means of transportation, it was impossible to replace this equipment until the following summer.

In 1854, Mr. Sampson Vivian, having acquired a lease for fourteen years from the Montreal Mining Company, of the western portion of the property, on a royalty of 5 per cent. on the dressed ore, succeeded in forming a company in England, under the auspices of Messrs. John Taylor & Sons. This concern, which was called the West Canada Mining Company, commenced opening out what is known as the Wellington Section; but soon after a teamster, named George Clark, searching for strayed cattle, found a lode, from which the moss and leaves had been burnt off in a recent bush fire, in consequence known as the Fire Lode, which name it still bears. He was rewarded with a barrel of flour. A shaft was started on this new find, and, in digging a water course, another and a wider lode was encountered. On tracing these to the westward it was found that a junction took place on the adjoining Huron Copper Bay location, and Messrs. Taylor & Sons very wisely secured a lease upon this and eventually purchased the whole location, including the Bruce Mines, from the Montreal Mining Company in 1864. It would appear that the Bruce area produced, up to 1857, 3,239 tons of 2,000 pounds, with an average value of 18 per cent. copper, containing 583.22 tons of fine copper.

The capital of the West Canada Mining Company was £200,000, and the cost of installation and development, with all the then

existing difficulties of transport, were so heavy that it was not until 1861 that the mines commenced to pay dividends. Dressing floors were erected on the Wellington and Huron Copper Bay sections; but the buildings not being enclosed, operations were confined to the summer months, the ore being mined and a large proportion left underground during the winter. The following statistics have been kindly placed at my disposal by Dr. Robert Bell, F.R.S., etc.:—

	Tons (2000 lbs.)	Tons fine copper
1858 Bruce & Wellington produced	1266 of 21.94% copper	=277.76
1859 Bruce & Wellington produced	1803 of 21.35% copper	=384.94
1860 Bruce & Wellington produced & Huron Copper Bay....	2411 of 20.50% copper	=494.25
1861 Bruce produced	555	
1861 Wellington do	1381	2421 19.60% copper=474.51
1861 Huron Copper Bay do..	485	
	7901	1641.46

In 1862 a disastrous bush fire almost wiped out the entire village. The company sent a subscription of £300 to assist those who suffered most, but the men refused to accept anything, and asked to be allowed to devote the money to form a nucleus for a public school fund, which was permitted.

From 1861 to 1868 an era of prosperity set in. The price of copper was good. At first the concentrates were shipped to England, but afterwards to the United States, until the war broke out; when a tax of five cents per pound was put upon copper, thus closing this market.

The average work done during nine years, according to the evidence given by Mr. William Plummer before the Royal Commission in 1890 was "sinking 87 fathoms, driving 113 fathoms and stoping 1,241 fathoms" per annum. This shows very plainly that the stoping ground opened up must have been very wide, taking into consideration the relatively small amount of the development work; in fact, quoting from the evidence of Mr. Frank Prout before the same Commission, "we generally paid about \$35 a fathom, the ordinary width being ten or twelve feet; when wider we paid more." Forty dollars per linear fathom, however, was nearer the average price paid, so presumably the lode was over twelve feet wide.

About 350 men and boys were employed, of whom 200 were underground. The cost of superintendence, wages and materials appears to have averaged \$12,000 per month. An extraordinary method of working seems to have been adopted, the price for driving a level on contract being \$120, the men finding powder, caps, fuse and candles, also steel sharpening, the company doing the mucking and hoisting. Whilst shaft sinking was \$240 and stoping \$40, but the men were only allowed to do a limited amount of work, so that their average earnings were \$40.25 a month. The dollar was calculated on Halifax currency of \$4 to the pound sterling.

During the years 1862-1868 the following shipments were made:—

	Tons (2000 lbs.)	Tons fine copper
1862 Bruce	446	
Wellington	1501	3154 of 19.65% copper=619.76
Huron Copper Bay ...	1207	
1863 Bruce		
Wellington		3719 of 20.00% copper=743.80
Huron Copper Bay ...		
1864 Bruce		
Wellington		3457 of 19.48% copper=673.44
Huron Copper Bay ...		
1865 Bruce (very little from)		
Wellington		3332 of 21.24% copper=707.71
Huron Copper Bay ...		
1866 Bruce (very little from)		
Wellington		4157 of 20.00% copper=831.40
Huron Copper Bay ...		
1867 Bruce (very little from)		
Wellington		3224 of 20.00% copper=644.80
Huron Copper Bay ...		
1868 Wellington		
Huron Copper Bay ...		3297 of 20.00% copper=659.40
	24340	4880.31

In 1868 the visit is recorded of Mr. John Taylor, Jr., who made a very full report upon the property, and the following extract sums up the situation at that time in a few words: First, heavy costs of dressing; second, great losses of copper during the process of concentration; third, heavy freight from the mines to England. He made two important recommendations; the smelting of the ore on the spot, and the reduction of the copper by means of salt and iron, known as the Henderson process.

Presumably, after due deliberation, it was resolved to send out, in 1869, Mr. Charles de Bussy to conduct a series of experiments as to the advantages of the Henderson process; and that these were successful is proved by the company erecting, during the years 1870-1871, a plant at a cost of \$200,000 (see Plate II, show-



PLATE II.—Old Lixiviation Works, Looking North, Bruce Mines, Ont. The Smoke Stack has since been pulled down.

ing all that remains to-day). From the returns it is evident that operations were conducted on a very limited scale during 1872-1873, and were then discontinued. It is stated that the cost of salt, scrap iron and coal was so heavy that the works could not be operated at a profit, although the extraction appears to have

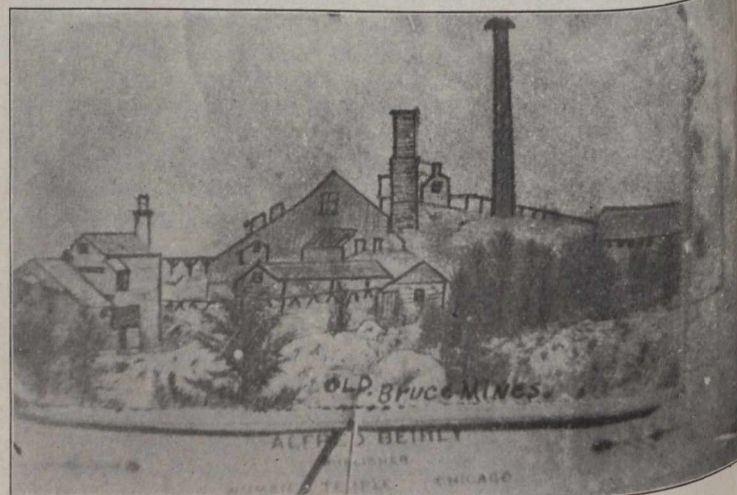


PLATE III.—Sketch of Lixiviation Works, 1871, Bruce Mines, Ont.

been as nearly perfect as possible. The writer has obtained 0.18 per cent of copper as a maximum from the heaps of waste.

During 1868 a certain amount of activity was shown in trying to make fresh discoveries. A shaft was sunk on the north lode, about one mile north of the Bruce section, and sunk 75 feet, but work was stopped, it is stated, because the men objected to walk so far to their work, and the shaft house headgear, etc., was destroyed by fire. Nearly equidistant between the Bruce and Wel-

lington sections the lode was found, and a trial shaft sunk 75 feet, then drifted on for 200 feet in each direction, viz., east and west, and a small stope put in on the west drift. Work was stopped here because it was said to cost too much to cart the ore to the dressing floors, not half a mile away; but the reason is difficult to understand, as the ore is of good quality, and the writer's assays, taken every six feet, will average over 4 per cent. Probably this was considered too poor in those days.

During the years 1896 to 1875 records show that 47,593 tons, of 2,000 lbs., were shipped, with a copper content of 9,562.96 tons, and sold, according to the best authorities, for \$3,300,000. The average copper contents were 20.09

What quality of ore was mined must be a matter of conjecture, but it is known that the late owners of the property sold 50,000 tons of tailings, or, as they are locally called, "skimpings," and the writer has measured 117,000 tons remaining on the property, whilst a quantity has been washed into the lake, and the Canadian Pacific Railway ballasted their line from here to Sault Ste. Marie, a distance of 36 miles, from the same source. It may fairly be assumed that 400,000 tons of rock were mined, of which 100,000 remain as waste on the dumps, and 300,000 tons probably can be shown as having been treated. With the exception of sinking Bray's or No. 2 Shaft to 420 feet, all this tonnage was won from above the 360 foot level.

If the average value of the ore, after deducting the waste, was four and a half per cent., it should have yielded 13,500 tons of copper, but as only 9,852 tons of copper are shown to have been shipped, it is evident that a loss of 41 per cent. was made in the treatment. Of course, this is merely an hypothesis, but is remarkably close to the estimates of both Messrs. Borron and Plummer, who compute a 40 per cent. loss. It will be noted that there are three epochs of seven years: the first, development; the second, bonanza; the third, gradual diminution for want of development. The debacle came in 1875, but after 1872 no developments were carried on, and presumably the costly experiment of the Henderson process so disheartened the proprietors that orders were given to take everything away worth getting out, at a minimum of cost. The result of this policy can be seen in the "Big Cave" (see Plate IV). Here the junction of the two lodes took place, and the ore must have been surprisingly rich, as it is currently—and the writer believes truthfully—reported that they had at one point 24 feet wide of ore. The greater part, known as "prill," was simply put in barrels and shipped. It is satisfactory to say that there is considerable evidence to show that this shoot of ore continues downwards, and the present company will benefit thereby. At any rate, the result of this way of working caused the "Big Cave." A party of six men had been working on a stope from, October, 1874, to March, 1875, and, according to measurement, the record of which exists, they had broken 33 fathoms, 1 foot 3 inches (width unknown, but probably 10 to 12 feet). Following the usual custom, the ore was left underground. Signs of what was coming were frequent, so much so that some men left the mine rather than run the risk. Fortunately for everybody, "the cave" occurred on a Saturday night, so no lives were lost, and the stope, not having been carried below the fifty fathom level, the sixty fathom level remained intact, the only loss being the ore accumulated as above stated. This was virtually the finish, although small parties of tributers worked during 1876. The mine was then closed down for its long sleep until 1898.

The property was in that year secured by some English capitalists, who, after unwatering the shafts, had an examination made by the celebrated mining engineer, Dr. Hatch. The result of this report was so satisfactory, in spite of the fact as above stated, that for three years the mine was literally robbed, that a company was formed in England and work resumed. Unfortunately, like so many other similar enterprises, the cart was put before the horse, a concentrating mill being erected to treat 400

tons a day, whilst underground development was not undertaken on an adequate scale. They, however, succeeded in proving that the lode is no less than 18 feet wide and over 3 per cent. in value, and this at a depth of 420 feet. Then a fire occurred, burning down the newly erected pit head gear, shaft house, with crusher and ore bin, blacksmith's shop, men's dry, power and boiler house, etc. This, naturally, was discouraging, and, occurring as it did during the South African war, the principal shareholders, who were greatly interested in the gold mines of the Transvaal, called the general manager to England, and, not being



PLATE IV.—No. 1 Lode. No. 2, or Fire Lode. East End of Big Cave, Bruce Mines, Ont.

satisfied that an output of 400 tons a day could be guaranteed, determined to stop all operations except those necessary to keep the mine dry. Even this they eventually stopped on April 23rd, 1904, and in March, 1905, the writer was commissioned to pump out and make an examination. This was done, and, the report being satisfactory, a company was registered in Ontario, but with English capital, and Wellington and Huron Copper Bay sections have been again unwatered.

The property held by the company consists of the entire mineral

rights over the old original grant of twenty square miles, but only 655 acres of surface rights remain of the former 12,800, of which about 300 form part of the town of Bruce and consist of valuable town sites, docks and water rights. In addition to the 400 ton concentrating mill, there is all the plant and machinery necessary for the mine's development in full working order.

The copper ores, chiefly chalcopyritic, which are found in such abundance, apparently are distributed in well-defined bodies or zones, but, taking into consideration the wide area over which discoveries have been made in this section of the country, and recognizing that these are only a fraction of the whole, it is impossible to deal with this subject within the limits of this paper. Suffice it to say that hardly a township exists without one or more ore bodies, and that it might fairly be stated that in the more settled parts there is hardly a farmer but has some indications of mineral wealth on his property; and it is evident that whatever treatment or process may be generally adopted in the future, it should be one that would enable the smallest as well as the largest producer to participate in, and thus aid in the gradual development of what must prove an immense addition to the mineral wealth of the country. In fact, the company is being constantly urged to erect a smelter sufficiently large to serve the general public in addition to its own requirement, and this should prove a great boon to those in the locality on whose properties are showings of copper.

GEOLOGY.

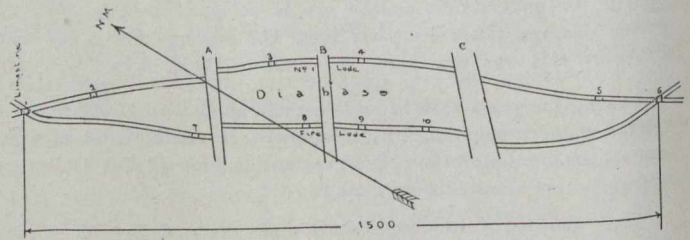
The geological sequences from Lake Huron through the Bruce Mines to the north are diabase in the lower slate conglomerate, encircled by dolomitic limestone and followed by the upper slate conglomerate, red quartzite, red jasper conglomerate, with white quartzite forming an anticline, of which the white quartzite is the apex. The lodes have an average strike of 25 degrees W of N., and dip, as a rule, almost vertically to the S.W., until the summit of the anticline is passed, when the dip, if any, is reversed, although there are ore bodies found with an E. and W. strike and dipping S.W. These occur in the upper conglomerate, and appear to be true fissures. All these rocks belong to the Huronian series.

ORE OCCURRENCE.

We have to deal with three classes of ore occurrence. First, in the quartzite, specular iron is often associated with the chalcopyrite, and in places chalcosite is found on the surface. This, on weathering, assumes the appearance of iron, so that the prospector should be warned of the resemblance. The siliceous ores are often accompanied by veins of calcite. Secondly, the fissure veins of the upper conglomerate. Although these were known in the earliest days, they appear to have been disregarded until recently, when a most important discovery was made on this property, and a most interesting one from a mineralogical point of view, as a collection of copper ores might be made from it, both black (melanconite) and red (cuprite) oxides, the latter followed by native copper in leaflets, besides the ordinary bornite, chalcosite and chalcopyrite, with apparently a little pyrrhotite. These can be seen *in situ*, not vertically, as might be expected, but horizontally, the native copper being to the south and followed by the other ores. The only other instance of this order of deposition known to the writer is found at the Spassky Copper Mines in Siberia, where solid chalcosite forms one wall with ore diminishing gradually in value over a width of thirty feet, where it carries only two per cent. As the gangue of these ores carries considerable lime, they would furnish suitable fluxes for the siliceous ores. The third series are the lodes formed in the diabase. A peculiar characteristic of these is that the larger deposits of quartz are found on the sides of what are to-day merely rounded knolls protruding above the ordinary ground level. In many cases glacial action has sheared the crown off, so that almost flat tables are formed, and then the numerous reticulated veinlets are very clearly seen crossing in every direction. (See Plate IV.) At times the larger ore bodies cross one another and form important

junctions, although continuing a serpentinous course with little or no alteration of their mineral contents, and yet preserving their average strike.

A typical plan of this occurrence can be seen on the Wellington



and Huron Copper Bay sections, now being worked by the Copper Mining & Smelting Company of Ontario, Limited.

- A. Aphanitic Dyke, 25 feet wide.
 B. " " 20 " "
 C. " " 40 " "
 No. 1. Palmer's Shaft, 360 feet deep.
 " 2. Bray's or No. 2 Shaft, 450 feet deep.
 " 3. Rowe's Shaft, 240 feet deep.
 " 4. Mitchell's or No. 3 Shaft, 240 feet deep.
 " 5. Scott's or No. 4 Shaft, 340 feet deep.
 " 6. Crazie's Shaft, 270 feet deep.
 " 7. Unknown. Depth about 75 feet.
 " 8. Collin's Shaft, 200 feet deep.
 " 9. Gribble's Shaft, 200 feet deep.
 " 10. Knight's Shaft, 210 feet deep.

The numerous shafts are relics of the time when hoisting was done by a horse whim.

Dolomitic limestone comes in at the N.W., and the northern portion has not been followed up. That on the south has been explored for 480 feet by an adit parallel to the limestone.

This gigantic horse, 1,500 feet in length, is crossed by three dykes, the material of which differs but slightly from the ordinary country rock. The centre one has not caused any alteration, but the other two are fracture planes, and the entire mass of ground has been forced twenty feet to the north, throwing the lodes accordingly. Whilst at the junction to the west of Palmer's shaft a very rich ore body was found, in parts twenty-four feet wide, to the east, at Crazie's, the junction did not produce anything like such high value, although the quartz is from eight to sixteen feet wide.

The principal ores are chalcopyrite, with a little bornite, and the gangue is highly siliceous. At the surface some very fine deposits of chalcosite were mined, and bornite at the 270 foot and 360 foot levels is again coming in. A typical analysis of poor ore shows:—

Silica	91%
Iron	4.35%
Gold01 oz.
Silver80 oz.
Copper	2.21%
Lime70%
Sulphur	Not stated.

The average run of the mine is three and one-half per cent., whilst the known extent of the lodes is 8,000 feet longitudinally.

TREATMENT OF ORE.

After being crushed to pass a two and one-half inch ring, the ore was fed to 24 inch rolls, from which it was elevated to sizing trommels, the oversize coming back for re-crushing, the finer feeding direct into the jigs. The waste from two series of jigs was again brought back for crushing, whilst the finer stuff went into spitzkasten and fed on to six foot Frue vanners, the waste from the second series of jigs being taken to a six foot Bryan mill and a 30 inch fine crushing roll. The resultant product was lifted by bucket elevators and fed to Linkenbach double-deck tables, 16 feet in diameter. Eventually these finer slimes were put

over another series of Frue vanners. This process of fine crushing appears somewhat complicated, but the idea was to crush very fine to make a high concentrate. They succeeded in obtaining 25.15 per cent., whilst the tailings went 0.53 per cent. (See Plate VII. of mill.)

Having obtained the concentrates, it was necessary to find a market for them, and this meant heavy freight and smelter charges. Therefore it is quite apparent that if blister copper could be produced the bulk of the ore, not only of this property but of the neighborhood, could be cheaply smelted, as they do not contain anything deleterious in the shape of zinc, arsenic, etc.

In order to do this a customs smelter should be built, so that the siliceous ores of our property might be mixed with the ores containing lime and iron, to form a suitable mixture for economic

present date, it may be stated in conclusion that since the first Exhibition in Hyde Park, London, England, 1851, to the St. Louis Exhibition in 1904, exhibits from these mines have gained medals for the display of ore, etc.

The high price of copper must have been a great inducement for the first owners of the property, as the following will show:—

	Per ton
1853.....	£136-16-0
1854.....	£140- 2-0
1855.....	£141-10-0
1858.....	£140- 0-0

To-day the market price is £102 per ton. Is it possible that we are again approaching a period of high prices, when the present company, with modern appliances and easy transportation,

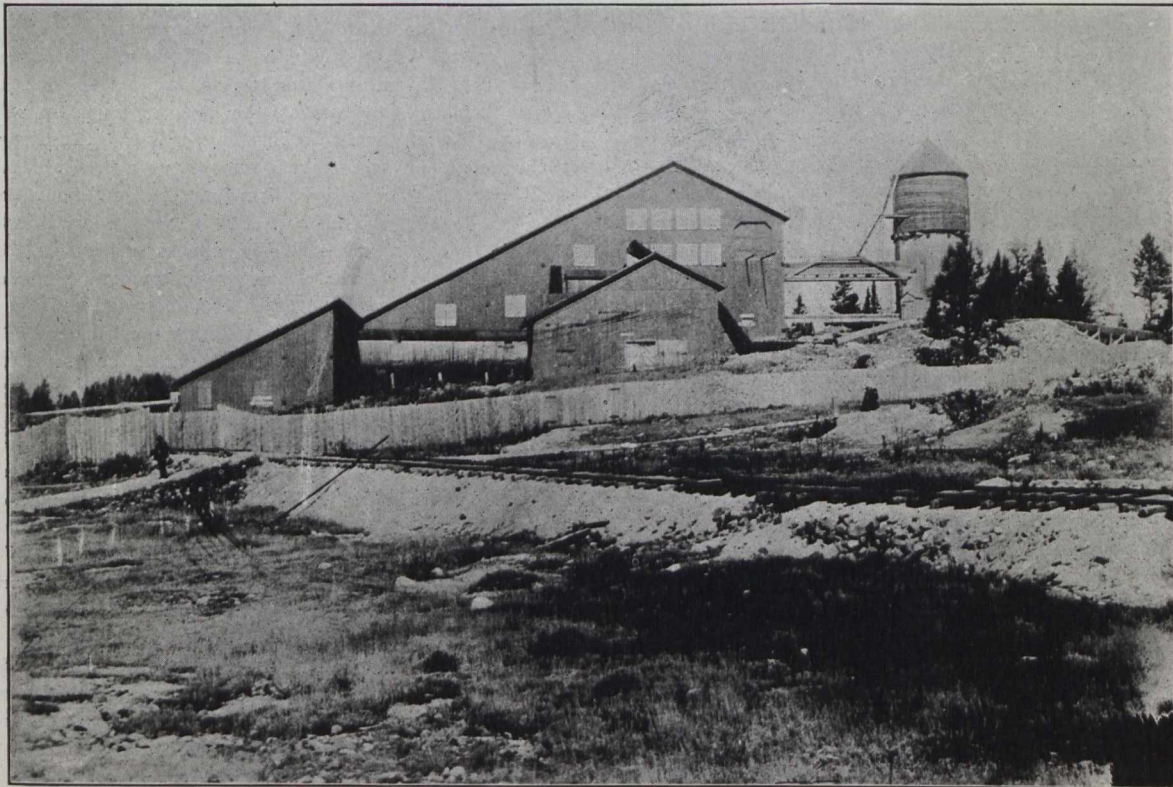


PLATE VII.—East End of 400-ton Mill. The Copper Mining & Smelting Company of Ontario, Limited, Bruce Mines, 1906.

smelting. The district is traversed by the Canadian Pacific Railway from Sudbury to Sault Ste. Marie, and bounded on the south by Lake Huron. Freight on coke and coal from the United States is low, and if it is settled that coal for coking purposes can be introduced free of the present duty of 53 cents per ton of 2,000 pounds, another industry would be added to the national wealth. In the event of the Provincial Government granting a bonus on refined copper, capital might be induced to erect a refinery, this, indeed, being the programme which the Copper Mining & Smelting Company of Ontario have seriously considered. The Governments, both Dominion and Provincial, have voted subsidies to the Bruce Mines & Algoma Railway, which traverses the property from south to north, and this, if pushed on to the C. P. R. main line at Chapleau, and thence on to the Grand Trunk Railway, now in course of construction, would open out great wealth in timber and mineral, and tap the great Clay Belt. But nothing is being done. Aid to improve existing roads and make new ones would be highly beneficial, as the writer is of the opinion that the solution of the whole problem of making copper mining a great success may be found in the erection of local smelters.

Having thus brought the history of Bruce Mines up to the

will reap greater benefits than were ever derived by former shareholders at the highest point of their prosperity.

The writer has purposely not dwelt at length on the geological features of the area, as the report now in course of preparation by Messrs. Ingall and Denis, of the staff of the Geological Survey of Canada, embodying, as it does, the work of two years in this neighborhood, will, when published by the Department (a preliminary report having already appeared in 1904*), afford a far more complete generalization than can here be attempted.

By a series of careful experiments it has been established that the corrosion of iron is not caused by the presence of carbon dioxide in the atmosphere, but by oxygen in conjunction with water. While carbon dioxide is not essential, it may accelerate the reaction.

The amphibole group of minerals are of similar composition to the pyroxenes. Trimolite, actinolite and hornblende are the chief members of this group. The fibrous minerals, asbestos and amianthus, are varieties of trimolite and actinolite. Hornblende forms a rock by itself and is an essential constituent of diorite, syenite, andesite, gabbro, and many crystalline schists.

GOLD MINING IN NOVA SCOTIA

BY GEO. W. STUART.

I have been asked to express an opinion as to the cause of the decline of gold mining in Nova Scotia.

The question would imply rather an erroneous impression, one not entirely borne out by the facts as established by the Government statistics. Last year, 1906, the yield of gold, by the sworn reports at the mines office, when compiled, will exceed 14,000 ounces. In no less than ten different years during the period since the inception of gold mining in the province (1862), the yield fell below these figures. The returns of 1874 show the minimum yield of 9,140 ounces, and the returns of 1898 show the maximum yield of 31,104 ounces. From 1872 to 1881 there was but little life, energy, or money, put into the business; therefore, with the exception of 1877, when the yield reached 16,882 ounces, the returns were, approximately, but from 9,000 to 13,000 ounces.

In 1881 there was conceived a new hope for the industry, caused by the discovery of a rich lead in the Montague district, known as the "rose lead." This lead was discovered far away from any float or drift, that escaped from it. The discovery was made through scientific conclusions and research, put into execution for the first time in the province. The methods adopted were freely made known to others, and soon other leads of much value were unearthed; among which was the new Caledonia, or DeWolf lead, in Montague, and the Dufferin at Salmon River, both large producers. From this date the yield steadily increased, until, in 1898, it reached the maximum above stated, 31,104 ounces. For the five succeeding years the average yield was 28,500 ounces, but in 1904 it dropped to 14,279 ounces. It will, therefore, be seen, by the above figures, that many times during the 45 years gold mining has been in progress in Nova Scotia it has been at a lower ebb than at the present time; at least less gold was reported to the Mines Office, as obtained.

Presuming that the greater portion of this gold obtained was mined at a profit, some idea may be formed of the great difference in the thicknesses of the veins it has been taken from, when we find by the tonnage returns so vast a difference in yield per ton. For instance, in 1865, 24,423 tons of ore yielded 25,454 ounces of gold—more than \$20 per ton. In 1882, 12,081 tons yielded 14,107 ounces, an average of \$23 per ton, while in 1902, 192,076 tons yielded but 28,279 ounces, only an average of about \$3 per ton of ore. It is not to be inferred, however, that the \$3 ore may not have been mined at a profit, or that the \$23 ore was mined at exceedingly great profit; but it is a reasonable conclusion that the initial expense for plant and appliances to mine large quantities of low grade ore, at a profit, is much greater than that of a plant to mine and mill small veins of rich ore.

Since 1882 the average yield of gold per ton of ore mined and milled has gradually—with some fluctuations—been lowering, until to-day the average is about \$5 per ton. The leads, however, now being worked are, in the main, much larger than the average in the earlier years of gold mining, and, I believe, though under adverse circumstances, to which I will shortly refer, all the mines now working for profit—and not simply doing development work—are succeeding.

Why the presumed decline? is the question I am asked. My answer is that there is a combination of causes and circumstances for the present unsatisfactory condition of gold mining in the province, none of which are the causes generally assigned by those of the outside world who are not in a position to know all the facts. Some, at least, of the causes I am about to refer to, could have been, and should have been, avoided, and some can be remedied yet, if those in power would take the slightest interest in the welfare of this industry.

Cause 1.—In the early years of gold mining in the province—up to the eighties—Nova Scotia miners were in plenty, at most reasonable wages; later, many of these men—some of the best of

them—went West, where they obtained much higher pay; and later, after the great mining boom started in our Western country, our miners practically deserted us, until, during the last eight or ten years, the greatest difficulty has been experienced in getting and keeping experienced men to operate our gold mines. Nova Scotia miners, when opportunities are afforded them, are recognized throughout this continent as being rather a superior class of workmen, and therefore they have been able to obtain wages abroad that the operators of mines here felt they could not afford to pay; therefore it has been constantly necessary to employ green men, and the experience has been that too many of them, as soon as a reasonable knowledge of the business is acquired, take flight to the regions where there is more boom and more excitement, and, as they believe, greater opportunities. Thus, mine operators are often left with their mines less than half manned.

Cause 2.—The excessive cost of fuel for power has played a most serious and paralyzing part in the cause; perhaps the greatest in the catalogue. Our mines are largely on the sea coast, mostly of easy access to shipping. Throughout all the early years of mining, and up to the taking over, under new leases from the Government, the large aggregation of coal mines in Cape Breton by the Dominion Coal Company, we were able to buy coal delivered at our wharves at a cost of from \$1.75 to \$2.75 per ton. Since the advent of this Dominion Coal Company into this country the price of coal in Nova Scotia has been nearly doubled in cost to us. This is a most serious drawback, and is the chief cause for the closing of a number of mines. Particularly has this been the case in the operation of low grade ores, on which the prosperity of the industry must depend in the future. This cause could have, and should have, been provided against by the Government when granting new coal leases to this powerful company.

It has been found, too, that in some of the more inland districts, where wood for fuel has to be used, and is fairly abundant, the large timber limit owners, who have acquired boundless areas at the nominal cost of forty cents an acre—surveys paid for by the Government—have put on practically prohibitory prices for wood, though only fit for fuel, and of no use for milling purposes. Thus the fuel question is the most serious one for all the districts.

Cause 3.—Large blocks of valuable areas are held in many of the districts by men who are, in some cases, mere speculators, and by others who are of the dog-in-the-manger type. These idle sections are entirely apart from those referred to, which have been closed down for the causes above mentioned, and this evil can only be remedied by an amended act.

Cause 4.—Much of the gold contained in our ores is coarse and nuggetty, and it has been a well-known fact that gold stealing has been practiced to an extent, in some mines, that necessitated closing them down; and yet, as the law is at present, no man can be convicted of stealing gold unless he is caught in the act. A workman may be found with any quantity of gold on him, or in his possession, but the owner—the man he has stolen it from—cannot prove it is his unless he—the thief—has been seen to take it. In Australia they have a law making it incumbent upon the possessor of unwrought gold to prove how he came in possession of it. This law has worked well, and has done wonders for the preservation of the mine owners, and the stimulation of the industry in that colony—where legislators look after the best interests of those who are legitimately developing its industries. These facts have been clearly shown to the Federal Government of this country, and for the past five years we have, through the Mining Society of this Province, been praying for such a law to protect us, but our appeals have been in vain.

None of the causes above enumerated can be charged to the gold mine owners. There are some causes, however, that lie at their own doors, and one is the indifference there has been exhibited in the gold-saving appliances. We have depended, practically, entirely on free amalgamation in the past, resulting,

beyond any shadow of doubt, in a large percentage of gold being lost, going out over the plates with the tailings, and being ultimately deposited in the lakes and swamps. I may say also that Nova Scotia has not escaped the consequences of reckless, incompetent and dishonest management. Perhaps we have had more than our share of such here.

Chiefly because of the reasons I have enumerated here, Nova Scotians have become discouraged, and capitalists abroad have become suspicious that our mines are not of a permanent character, and that they are too expensive to work.

I do not believe such conclusions are justifiable, and I trust, and believe, the two foreign companies now operating here, one in an eastern district and the other in a western district, will fully demonstrate the error of such conclusions. They have both adopted the modern cyaniding system of saving gold.

I believe there is yet a prosperous future for gold mining in Nova Scotia. We must, however, have faith sufficient to do more underground exploration work, and we must divest ourselves of the too prevalent idea that all pay zones in all lodes crop to the surface somewhere; operations in the past have practically been confined to lodes discovered by such out-croppings.

We must also take advantage of the numerous water powers now running to waste, and install electric plants that will make us less dependent upon the fuel situation.

Truro, N.S., Feb. 20, 1907.

THE LONG WALL SYSTEM OF COAL MINING

By T. W. GRAY, Glace Bay, N. S.

The Emery seam, which lies at a depth of about 160 feet below the Phalen seam in the Glace Bay coal field, is being worked by the Dominion Coal Company at their reserve mines on the long-wall extraction method, for which it is admirably suited. The seam has a good strong roof, which breaks well, and consists of about four feet six inches of clean, hard, bright coal of good quality, very suitable for domestic or steam-raising purposes.

"Long wall" is somewhat of a novelty in Cape Breton, at least in the Glace Bay district, and the native miner, who has been used to board and pillar workings in seams from six to nine feet high, does not take very kindly to the more confined areas of a four foot six inch seam. As a result, the Emery mine at reserve has become more or less of an "old countryman's mine," long wall being almost universal on the other side of the water. Quite a number of continental miners are employed here, particularly Belgians, who are good men for the work, and, after the tortuous and heated workings to which they have been accustomed, they find agreeable conditions in the cool and shallow mines here.

The coal is undercut five feet six inches with a compressed air disc coal-cutting machine, made by the Diamond Coal-Cutter Company, of Wakefield, England. The Coal Company have about half a dozen of these machines.

At present there are only two short faces, five hundred and two hundred and fifty feet long respectively, producing about three hundred tons a day, but they are being rapidly extended.

The product of long wall operations is very blocky and strong. It is not powder-shaken, because the roof weight is sufficient to break down the undercut coal with the expenditure of very little or no powder.

A portion of the Phalen seam at No. 6 colliery (Big Glace Bay) is also being worked on the long wall plan, with marked success. There can be no doubt that these are only the beginnings of a more extended use of this method, as the thicker seams, which do not lend themselves to long wall, become exhausted, and the development of long wall work in Cape Breton will be followed with great interest by mining men, as it will involve radical changes in present conditions, both technical and economic.

In England, the use of long wall coal cutters, combined with conveyor belt systems along the face, has rendered it possible to profitably work seams as thin as 16 inches.

T. W. GRAY.

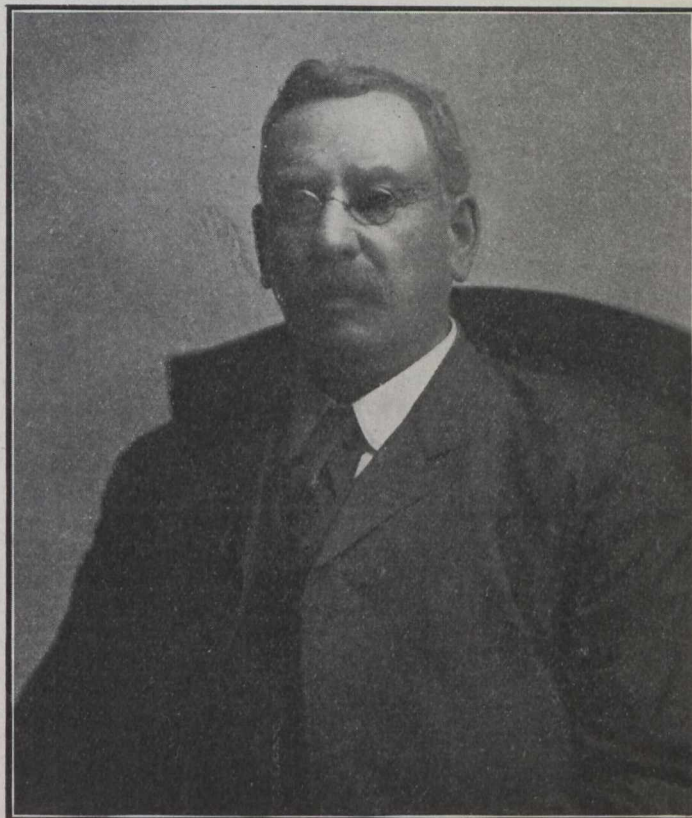
Glace Bay, N.S.

INDUSTRIAL PIONEERS OF CANADA

Born in New Glasgow, in 1846, Mr. Fraser showed early in his career a decided leaning towards mechanical work.

As an apprentice he worked for some years at blacksmithing in Providence, R. I.

After marrying Miss Charlotte Dicks, of Pietou, he returned to his native town. His first important work resulted from securing a contract for the iron work of the wooden vessels then being built by Mr. Carmichael.



GRAHAM FRASER.

In 1872, Mr. Fraser, along with Mr. G. F. McKay, established the Hope Iron Works, with a capital of \$4,000.

After a year of successful work, a steam hammer was added to their equipment. Then another steam hammer was acquired, and the name of the firm was changed to the Nova Scotia Forge Company. In 1878 the forge works were removed to the present site of the steel works at Trenton, near New Glasgow.

In 1882 Mr. Fraser issued the prospectus of the Nova Scotia Steel & Coal Company, and, until December, 1903, he was the vice-president and managing director of that sound and flourishing enterprise. From that date until January 1st, 1904, he filled the offices of director and director of works for the Dominion Iron & Steel Company, of Sydney, N.S. Mr. Fraser resigned this important position as soon as he had accomplished the task of re-organizing the Steel Company. Since then he has not taken any active part in business.

To Mr. Fraser belongs the credit of having first conceived the idea of establishing a great iron and steel plant at Sydney. Asso-

ciated with Mr. Fraser in much of his work, such men as his brother, Mr. Simon A. Fraser, Mr. Thomas Cantley, and Mr. Harvey Graham, have won prominence.

Mr. Fraser is a most unassuming, pleasant Pictou County Scotchman. Intelligent industry and unswerving integrity have been the keystones of his success.

ROASTING OF THE ARGENTIFEROUS COBALT-NICKEL ARSENIDES OF TEMISKAMING, ONT., CANADA*

CYRIL W. KNIGHT.

The Cobalt ores consist essentially of arsenides of cobalt and nickel, together with native silver. In going over the literature on roasting of arsenides, no definite data could be found which gave accurate information regarding the temperature at which arsenic is expelled during roasting operations. A few experiments

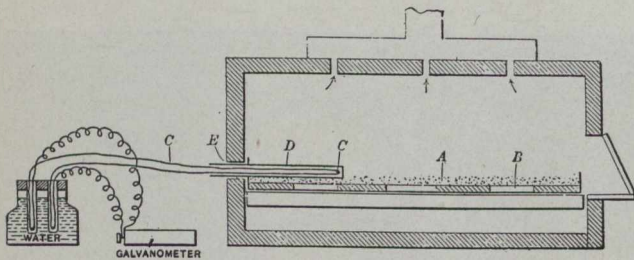


FIG. 1.

were therefore undertaken, with the object of throwing some light on this point; and it was also thought that the metallurgical plants now being erected in Ontario to treat our Cobalt ores, might, perhaps, obtain some information from the work.

The roasting was done in an American Gas Furnace Company's oven, No. 2 (Fig. 1), 27 inches long and 20 inches wide inside.

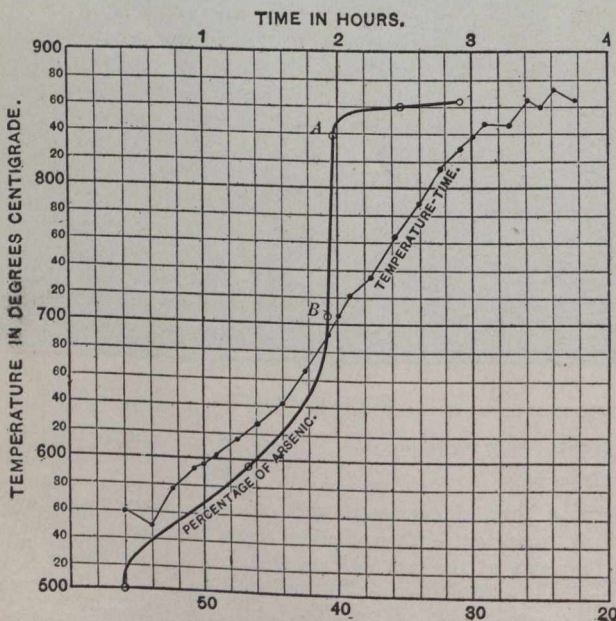


FIG. 2.

The ore was held in iron pans, lined with 0.5 inch fire-brick, B. "The temperature was measured by means of a Le Chatelier pyrometer. The thermo-couple, C, was protected from arsenic and other fumes by a porcelain tube, D, and was placed immediately

*Summary of a paper published in the Transactions of the American Institute of Mining Engineers, April, 1907, by Henry M. Howe, LL.D., William Campbell, Ph.D., and Cyril W. Knight, B.Sc., respectively professor, instructor and student of metallurgy in the School of Mines of Columbia University, in the city of New York.

above the ore, A. It entered through a circular hole, E, in the back of the furnace, and was connected with a Keiser and Schmidt galvanometer, standardized by means of the melting-points of zinc, aluminium and copper. The temperature was recorded and the ore rabbed every ten minutes. In none of the roasts was any fritting or clogging of the ore noticed.

The first object was to ascertain the temperature at which the arsenic is most rapidly expelled. The ore treated was ground to pass a 20-mesh sieve. The furnace was gradually heated at the rate of 120 degrees C. per hour to a maximum of 870 degrees C. It was found that, during this roast, 27 per cent. of the total arsenic was expelled below 700 degrees C. That practically no arsenic was expelled between 700 degrees C. and 840 degrees C., but that, on reaching the latter temperature, expulsion again became rapid. This is diagrammatically shown in Fig. 2. These results tend to prove that the behavior of smaltite resembles that of pyrite, of which the first atom of sulphur is removed at a much lower temperature than the second.

The second object was to ascertain how thoroughly arsenic can be expelled at 890 degrees C. (a temperature a little above that at which it was found that arsenic is rapidly driven off). The furnace was raised quickly to 890 degrees C., and held near that temperature for four hours. The arsenic content at the end of the roast was about 17 per cent. During the first three hours it fell to 19.3 per cent.; the effect of the last hour of roasting only reduced it to 17 per cent. Fig. 3 gives a curve showing diagrammatically the results of the test.

It was found that charcoal, whether added at the beginning or towards the end of the roast, failed to increase the expulsion of the arsenic. In one experiment the ore treated was ground to pass a sieve of 100 meshes to the linear inch. This did not increase the amount of arsenic driven off.

ASBESTOS DISCOVERIES IN FOREIGN COUNTRIES

BY FRITZ CIRKEL, MINING ENGINEER, MONTREAL.

Those familiar with the asbestos market are aware that the present supply of asbestos is not sufficient to meet the world's demand. This is principally due to the increasing uses and applications of the mineral for industrial purposes. It may be affirmed that the output of all the existing asbestos mines is insufficient to satisfy two-thirds of the demand for this product, and the leading manufacturing firms interested in this industry are diligently searching for new deposits. As a matter of fact, European manufacturers, who find the supply insufficient and irregular, have endeavored to acquire asbestos mines in Canada, but have been confronted with many difficulties, especially in the comparatively small Thetford-Black Lake asbestos area, there being comparatively few productive mines, and these can only be had at exorbitant prices. For this reason, European manufacturers, for the last year or two, have been informing themselves of opportunities in other countries. Thus, Englishmen propose to acquire some recent discoveries in Western Australia, in the vicinity of Perth, where, it is reported, asbestos of quality equal to the Canadian product has been found, although information regarding the location and extent of the deposits is being kept a close secret.

We hear also that renewed attention is being paid to the Ural (Russian) deposits, but whether they ever will assume the importance of the Canadian mines remains to be seen. Two deposits of asbestos were discovered last summer on the Ural, one in the Verchoturksy and the other in the Ekaterinbourg districts of the Province of Perm. In the first named district prospecting is carried on by a mining engineer, Mr. A. L. Simchowitch, in a locality called Znamenskaia Datcha. By order of the chief administrator of the Ural mines, the above area was declared free for exploration, and the right to prospect was granted to Mr. Simchowitch for a period of five years.

These asbestos deposits were discovered quite accidentally last

spring, and are located in the very midst of a village, near to some chemical works.

Asbestos mines on the Ural have been in operation for years, and, from the statistics available, the production is steadily increasing. Particularly well regulated is the asbestos manufacture at the asbestos mines at Korevo, thirty versts from Bajenovo Station on the Perm Railway. The entire district is covered with heavy drift material, containing auriferous sand and precious stones, such as emerald, amethyst, topaz, spinel, beryl, etc.; in fact some of the best emerald mines are situated in this district. The country is moderately flat. It is densely timbered, and for this reason prospecting is a difficult task. The formation is a weathered serpentine, much decomposed, and evidently has undergone many disturbances. The asbestos is found in cracks or fissures, similar to the slickensides in Thetford and Black Lake, and is, to some extent, discolored. It is of a fine and silky texture a true asbestos, a form of fibred tremolite and hornblende, and its principal value for manufacturers lies in its tensile strength.

It is not, however, as silky as the Canadian chrysotile. The fibre is a little coarser, of slightly yellow color, and is well adapted for spinning purposes. Most of the asbestos is short, fibre of two and two and a half inches in length being very rare. Two companies are working in the district, the "Poklewsky

Kosell" and the "Korrewo Company." The former is the largest company in the district, and employed at one time 5,000 men. But the drawbacks for a healthy and steady progress of the industry are great, the principal ones being the shortness of the season, which lasts only six to eight weeks, and the remoteness of the district.

The mines are remarkable for the fact that, even with a production of 1,500 to 1,700 tons of asbestos per season, the mining work is all done without the aid of machinery or explosives. The ground carries more asbestos to a given area than the Canadian mines, but the veins are not so thick, nor is the color very white. Mining operations are carried on upon a very antiquated system, while a proper milling plant does not exist. Experiments in milling are, however, in progress, and are vivid reminders of what occurred at the Quebec mines years ago. The working force at these mines numbers, as a rule, up to 1,700 men in the season, and is recruited from the Russian Muzhiks or peasants. The wages paid ordinary labor are about thirty-three to thirty-eight cents a day, with free sleeping quarters. These mines, as a rule, suffer from a scarcity of labor during the harvesting time. Adjacent lakes will prevent them from ever attaining the depths of our mines, owing to the very porous and disturbed nature of the rock, the lakes being on nearly the same level as the mines.

MINING POSSIBILITIES IN THE PROVINCE OF QUEBEC

(BY FRITZ CIRKEL, M.E., Montreal.)

(Toronto Meeting Canadian Mining Institute, 1907.)

The establishment of a mining industry in the Province of Quebec is of long standing, and it were, therefore, reasonable to expect that mineral production from this Province should be proportionately considerable. But this is not the case. In 1905 the total value of the minerals produced amounted only to \$3,750,000, an insignificant aggregate in relation to the importance and the varied mineral resources of the area. The question arises, to what cause is this unsatisfactory state of affairs attributable?

The public as a rule finds ready explanation in blaming government for slow industrial progress; but in the present instance this can not be done in fairness. Enquiring into conditions connected with the Quebec mining industry, we find that the Provincial Government has done much to promote mining, and the laws governing the latter are as liberal as can be found in any other mining country, where conditions are similar; and we must, therefore, look elsewhere for reasons.

Meanwhile, if we examine statistics published annually by the Quebec Government, we will observe that the precious metals are absent from the list, and the entire production, practically, is that of minerals not classed as precious.

Thus we have, among others, mentioned:

Iron ore, with gross value of production of...	\$	35,268
Chromic iron	"	104,565
Copper ore	"	128,850
Asbestos	"	1,476,450
Asbestic	"	31,100
Mica	"	95,460

Considering the mineral potentialities of the Province of Quebec, this showing is most inadequate, and the reason thereof is solely attributable to the indifference of the public. Nowadays fabulously rich finds in other provinces of the Dominion have attracted wide attention, and it is not difficult to find capital for the exploitation of precious mineral deposits of even questionable value. But it is difficult to interest investors in deposits of base

minerals in this Province promising safe and fair returns on money invested. This point might be illustrated by numerous examples which have come under the writer's notice. But reference need only be made to the absence of interest in our magnetic iron resources by way of demonstration.

It is well known that the Province of Quebec is very rich in iron ores, especially in magnetic iron; these deposits are distributed along the banks of the St. Lawrence, Ottawa and Gatineau Rivers, and are of good quality, quite equal to the Swedish ores.

The magnetic sand deposits on the north shore of the St. Lawrence were discovered over forty years ago, but remain still undeveloped. These deposits are of considerable magnitude at certain points, such as at Moisie, Mingan, Betsiamits, Natashquan, Kagashka.

The magnetic sand is found almost on the surface in stratified beds from one-half inch to six inches thick, but sometimes attaining a thickness of from one and one-half to two feet. These deposits extend over large surfaces on the coast, in some instances for several leagues. Besides magnetic iron, this sand contains quartz, red garnet and titanite iron.

But the principal magnetic iron ores are located in the Township of Pontiac and in Hull, north of Ottawa. In each of these localities, mining operations were carried on some thirty or forty years ago; but work was discontinued, not on account of a falling off in the quality or quantity of ore, but in consequence of loss in handling. Separation methods for the purpose of freeing the iron ore from the gangue are of comparatively recent date; and by these means mines which formerly could not be profitably operated can now be made to pay handsome returns. Most people, acquainted with the early operations of these mines, when approached for an opinion regarding their present value, refer to former failures and express an unfavorable view, forgetting that conditions now have greatly changed for the better, and that these former failures were ascribable to the one cause already

explained. In proof of this contention the mines of the Adirondack region may be instancer.

There has ever been a disposition to under-estimate the great importance of the magnetic iron ores of the Ottawa and Pontiac counties, the specific objection raised against the availability of the ores in that region being that the cost of fuel to smelt the ore is prohibitive. With the steadily decreasing quantity of coal required per unit of finished product, due to the better utilization of fuel by modern methods, this objection is, however, of lessening importance, while on the other hand we have these favorable factors: The ores are rich, the bodies are large, and cheaply mined, for little timbering or pumping is necessary. The objection is occasionally raised that magnetic ores are not as readily reduced in the furnace as hematites, and are, therefore, not worth as much to the smelter. In a general way this is true, although one fact deserves consideration, and that is that magnetites are practically free from moisture, so that their carriage is proportionately less. It is estimated by one of the leading furnacemen in the country, that magnetite involves an extra expenditure in smelting of about twenty-five cents per ton of pig, and even that is only a general statement, since there is considerable difference in the ease with which different magnetites are reduced in the furnace. An interesting practice bearing on this point has been developed at the Wharton furnaces, where New Jersey magnetites are roasted in kilns fired with waste furnace gas, or with producer gas, before being charged into the furnace, a practice for which important economics are claimed.

Another feature which speaks greatly in favor of cheap reduction is the enormous amount of available water power in the vicinity of the mines, which could be readily used for the production of electric energy in electric smelting, as suggested by Dr. Haanel, Dominion Superintendent of Mines; and reference may be here made to the Chats Falls, on the Ottawa River, near the Bristol Mines, and to the Chelsea Falls, on the Gatineau River, in the vicinity of the Ironsides Mines, where more than 50,000 horse-power can be cheaply produced for general mining and smelting purposes.

Referring to the concentration of these iron ores, which are to a great extent of low grade, it should be stated that the Port Henri mines in the Adirondacks, where conditions are similar to those obtaining in the Ottawa and Pontiac counties, have successfully adopted separation processes.

For years the concentration of low grade ores by some form of electro-magnetic separator has attracted the interest of the miner and inventor alike. Among the first to test and develop processes of magnetic separation in the Adirondacks were Witherbee, Sherman & Company, who were called upon to meet two sets of conditions. The New Bed and Harmony ores, low in phosphorus and varying in purity from 40 to 69 per cent. iron, form one group, while Old Bed ores, practically of uniform grade at 60 per cent. iron, but high in phosphorus—1.35 to 2.25 per cent.—form the second group. The magnetic separation, or rather purification, of the latter is particularly interesting and unique, the problem being to eliminate the apatite or phosphorus-bearing gangue, which is practically non-magnetic. The apatite varies in color and in the size of crystals. These two characteristics have a bearing upon the degree of concentration possible. In the case of the apatite of a deep red color the magnetic characteristics are sufficient to carry at times an appreciable percentage of the free crystals into the iron concentrates. Then, too, these deep red crystals adhere more tenaciously to the crystals of magnetite than the green or yellow varieties. The yellow apatite crystals break away most freely from the magnetite. When the magnetite is a shot ore, or of large crystalline structure, it is not difficult to bring the ore into a condition admitting of practical concentration. When the ore is massive, or the crystals of magnetite and apatite are both small and finely disseminated throughout the mass, finer crushing is necessary for the same degree of concentration.

In order to meet these conditions of the ore, it has been found necessary to carefully prepare the ore by crushing, drying and sizing before treating it on the magnetic separators. Aside from this treatment for physical peculiarities of the ores, a rough cobbing is made at the pit head, the first-grade product being sent direct to the furnaces and the second-grade ores being sent to the separators, except at such times when the whole run of mine is concentrated.

To make the Old Bed high phosphorus ores of more value to the blast furnaces, Witherbee, Sherman & Company built a separating plant about two years ago, and later erected another mill, to care for the total output of this grade of ore. During the two years of operation of the plants the methods of treatment have been improved from time to time to assure uniformity of product. While from the start the process has been a commercial success, the improvements introduced have tended to lower the percentage of phosphorus. It is very doubtful if a true Bessemer product can ever be made from Old Bed ores, yet the limits of variation in the phosphorus of the concentrates are being narrowed.

The separating plant is divided into three main sections, the crushing plant, the separating plant and the re-treating plant. Each of these product divisions is also made a power division, a motor being so placed as to control the machinery and conveyors in each division without reference to the others. In the original plant direct current motors are in use; in the second plant alternating current is the motive power. Between each division there are interposed bins, which, through their storage capacity, make it possible to operate each section individually for about two hours without obtaining fresh supplies from the preceding section.

Crushing Division.—The crude ore is first crushed in a 30x18 inch Blake crusher, operating at a speed of 250 revolutions, to 1.50 to 2 inch cubes. The resulting product is then passed over a screen of 0.75 inch opening, the oversize being crushed to 0.75 inch cubes in a Blake 36 x 6 inch double jaw crusher, running at 225 revolutions. The material passing through the screen and the crushed product unite, and are again screened over a six-mesh screen, the ruling size of the mill. The oversize is crushed in a set of 36 x 14 inch Reliance rolls, of Allis-Chalmers make, running 100 revolutions. The troughs of the screens and the product of the rolls unite, and the combined materials are passed through a dryer.

The dryer is a square vertical stack, with baffle bars placed at right angles to one another in alternate sections, there being eight sections with six rows of bars to a section, and six bars to a row. In falling over these bars the body of ore is broken up and permits a free circulation of hot air throughout the mass. The ore being fed in at the top of the dryer, passes constantly into a hotter zone, the heated gases from the grate passing from bottom to top of the stack. On discharging at the bottom of the dryer the ore is elevated to a tower screen, having 288 square feet of screening surface. This screen is divided into equal sections of 30, 16, 10 and 6 mesh screens. The product of each size screen is delivered to a separate pocket in a bin. The oversize of the screens is returned to a set of 36 x 14 inch Reliance rolls, so placed that the product of the rolls meets the original stream from the dryer. By this arrangement material is confined to a closed circuit, the only outlet being through the screens. The finest screens of the series are placed at the top, in order that the coarser particles may scrub the fine material through and cause a more effective sizing.

The object sought by frequent screening is the elimination at each stage of the coarse ore, thus preventing pulverization. That the process amply pays is shown in the fact that of the total shipping product about 65 per cent. consists of particles larger than ten mesh—an ideal ore for blast furnace use, as has been fully demonstrated during the past two years.

Separating Division.—Under each pocket of the bin is placed a Rowand Type F magnetic separator, treating one size ore. Ball & Norton separators have lately been introduced on the 30 and

16 mesh sizes. These separators operate in conjunction with the Rowand machines. Both makes of separators are so arranged as to make heads and tails. The heads, or concentrates, are sent direct to the shipping bin, and the tails, containing iron, apatite, hornblende, and a small quantity of silica rock, are re-treated.

Re-treating Division.—The tails from the Rowand Type F and Ball & Norton separators are passed over a screening surface of 72 square feet, equally divided into 20 and 16 mesh sizes. The oversize is passed to a Wenstrom magnetic separator, where the free iron remaining in the tails of the previous separation is recovered, the Wenstrom tails being returned to the 20 and 16 mesh screens after having been re-crushed in a set of 36 x 14 inch Reliance rolls. The product of the rolls meets the original stream from the Rowand Type F and Ball & Norton separators. As in the previous instance, the tails for re-treatment are in a closed circuit and must pass through the screens or over the Wenstrom separator. That portion which has passed through the screens is then treated upon two Wetherill Type E separators. The iron is first removed and is passed into the iron concentrates, along with the concentrates from the Wenstrom separator mentioned above. The hornblende forms a middlings product from these separators, and is passed off as mill tails. The apatite and silica being non-magnetic, form the tails of the separator and are classed as apatite concentrates, carrying from 60 to 65 per cent. bone phosphate. The mill tails carry sufficient apatite to raise the percentage of bone phosphate to from 40 to 45 per cent., and form a second or low grade apatite concentrate.

The concentration operation thus produces three products of market value, iron concentrates, apatite concentrates, and second-grade apatite concentrates.

The mills are each capable of treating 800 tons of crude Old Bed ore in 20 hours. Of the crude material 85 per cent. is recovered as iron concentrates, the 15 per cent. of tailings being equally divided between the first and second-grade apatite concentrates. On a basis of 800 tons of crude ore the products would be as follows:—

	Tons.
Crude ore	800
Iron concentrates	680
First-grade apatite concentrates	60
Second-grade apatite concentrate	60

The average analyses for the past ten months are as follows:—

	Iron	Per cent. Phos-	Bone Phos-
	phorus	phate	
High phosphorus Old Bed crude ore ...	59.59	1.74
Old Bed concentrates	67.34	0.675
First-grade apatite concentrates ...	3.55	12.71	63.55
Second-grade apatite concentrates ...	12.14	8.06	40.30

The other elements of Old Bed concentrates are:—

	Per cent.
Silica	2.20
Manganese	0.08
Alumina	0.90
Lime	3.84
Magnesia	0.31
Sulphur	trace

These mills are also capable of treating 600 tons of Harmony and New Bed crude ore in 20 hours. Of the product 77 per cent., or 462 tons, are recovered as concentrates, the remaining 23 per cent., or 138 tons, being discharged as tailings. These tailings are used for granolithic and concrete purposes, railroad ballasting and marble facing and cutting, the sharp edges of each particle being a far superior medium than water washed sands, where the edges have been destroyed by the action of the water.

Analyses of Harmony concentrates, from October 2 to November 13, 1903, gave the following results:—

	Per cent Iron	Per cent Phos-
	phorus	
Lean Harmony crude ore	50.26	0.295
Harmony concentrates	64.10	0.133
Harmony tailings	13.97	0.877

From the above general description of the Port Henry Mines it will be seen that most of the successes are to the elaborate system of concentration and mine equipment, and that the initial

difficulties which had to be overcome in preparing the lean ore for the market are similar to those confronting us in Canada. No attempt has yet been made in this country to concentrate our magnetic iron ores on an economic scale, although the deposits contain very large quantities of lean ore accompanying the rich streaks. It is impossible to make these mines pay by simply cobbing the ore, as was done years ago, but if capital were to undertake in earnest the utilization of these resources by the employment of modern methods of concentration, it might expect with assurance a rich reward.

REPORT OF THE ONTARIO BUREAU OF MINES FOR 1906

This fifteenth annual report of the Ontario Bureau of Mines contains much well-arranged, carefully-edited information. Both its appearance and its contents reflect credit upon the Department. It is profusely illustrated, and, typographically very little is left to be desired.

In Part I. a statistical review is followed by Dr. W. L. Goodwin's report upon the Summer Mining Classes, which were conducted in many of the remoter mining camps. About 550 persons received instruction by means of these classes. Nearly all of those attending were given sets of forty specimens. Much appreciation was shown by miners and prospectors.

Mr. E. T. Corkill's report on the Mines of Ontario covers the whole Province. It is edifying to glance over the variety of minerals being profitably mined in Ontario. The whole gamut is run, from gold and silver down through copper, zinc and lead to talc, fluorspar and marble.

Mr. Eugene Coste summarizes the progress of the natural gas and petroleum industries.

"Reports upon Exploration in Mattagami Valley," by Mr. H. L. Kerr; upon the "Agricultural Resources of Mattagami," by Mr. Archibald Henderson, and upon "The Amimikie Iron Range," by Mr. L. P. Getini, are succeeded by Dr. A. P. Coleman's paper on the "Iron Ranges of Eastern Michipicoten." In a note on the Helen Iron Mine, Dr. Coleman mentions an interesting occurrence of yellow ochre, disclosed by draining operations, at the east end of Old Boyer Lake; and shows that this phenomenon, along with the formation of concretionary limonite in shallow water, may be taken as evidence that solution of the ore and subsequent deposition is still going on. This district will evidently respond to detailed investigation. Additional notes on Michipicoten, by Mr. E. S. Moore, close Part I.

In Part II., under the title "Clay and the Clay Industry of Ontario," Mr. M.B. Baker deals exhaustively, clearly and well with a subject which deserves especial attention. Professor Miller, in a short preface, writes thus: "The more stable but more prosaic mineral industries of a country are apt to be somewhat neglected for those which appeal more strongly to men's imagination or cupidity. The clay working industry, which, next to agriculture, can be called the most ancient of industries, has up to the present been almost ignored by scientific workers, although during late years in Germany, the United States, and in other countries, it has been receiving more attention. Several . . . countries now have departments devoted to the study of clay and its products. In Ontario the clay industry has grown rapidly during recent years. Brick, which is cheaper than stone, is being used in modern cities in place of wood for fire protection purposes. As years go on the clay industry must become proportionately more important. It is well, therefore, at this time, for Ontario to have a systematic report, such as that of Mr. Baker's on 'Clay and the Clay Industry.'"

In this we most heartily concur. Space will not permit us to dwell further upon Mr. Baker's report. But it is our intention to take it up in detail at a later date. Meanwhile, we recommend it as a wholesome and appropriate antidote for Cobalt fever.

Some Notes on the Economic Geology of the Skeena River

By W. W. LEACH, Ottawa, Ontario.

(Toronto Meeting Canadian Mining Institute, 1907.)

By permission of the Director of the Geological Survey of Canada.

Since the Grand Trunk Pacific scheme was first projected, a great deal of interest has been aroused in the potentialities of the country through which this road will pass. Up to the present, however, the attention of the public has been turned chiefly to the eastern and prairie sections, the uncertainty of the route through the mountainous districts of British Columbia having deterred many from exploring that part of the country in the hope of locating valuable minerals, lands and timber in advance of the railroad.

At the present time it seems fairly definitely settled that the road will pass down at least part of the Skeena valley, and during the past two seasons a number of prospectors have found their way into that district, many coal and mineral claims have been staked, and a great deal of the available arable land taken up.

Although this was one of the first parts of British Columbia to be traversed by the earlier explorers, Sir Alexander Mackenzie having crossed from the Peace River to Bella Coola on the Pacific (passing a short distance south of the Skeena waters) as early as 1793, very little is yet known of the economic geology of the region. The only official reports, known to the writer, dealing with this subject are those by Dr. Dawson, contained in the Report of Progress of the Geological Survey for the years 1879-80, and by Mr. Wm. Fleet Robertson, the British Columbia Provincial Mineralogist (see Report of Minister of Mines, B.C., 1905). Dr. Dawson's work consisted of a hurried exploration from Port Simpson to Edmonton, following the main travelled trails, and with the map accompanying it, affords the only reliable information of much of this country to-day. Mr. Robertson's report, as far as geology is concerned, deals chiefly with a number of prospects in and adjacent to the Bulkley valley.

Up to the last few years little or no prospecting has been done in this great district, if we except the placer miners, who have overrun the greater part of it pretty thoroughly, but without any very startling results.

The rocks of the Skeena River may be roughly grouped into four main divisions, to which, in their southern continuation in the neighborhood of Francois Lake, Dr. Dawson has applied the following nomenclature, beginning at the oldest:—1st, The Cascade Crystalline Series; 2nd, The Cache Creek Group; 3rd, The Porphyrite Group; and, 4th, Rocks of Tertiary Age.

The Cascade Crystalline Series extends in a belt along the coast and is crossed, more or less at right angles, by the river, and has here a width of 50 to 60 miles. These rocks consist chiefly of gneisses, granitic rocks and micaceous schists, generally much disturbed and usually found dipping at high angles; they are supposed to be of Palæozoic age, probable carboniferous or older. Up to the present they have not been found to contain many large or valuable mineral deposits, although various minerals of economic value have been reported as occurring in these rocks at different localities in this neighborhood, notably, pyrrhotite and chalcopyrite on the Tshimpsian Peninsula, back of Port Simpson, galena and copper pyrites at the head of Kitamat Arm, and iron ore on the Eestall River, near Port Essington. It is highly probable, however, that future prospecting will bring to light other occurrences of valuable minerals, as the extremely wet climate of the coast region, with the resultant rank growth of underbrush and heavy covering of moss, has deterred many from prospecting this part of the district with any degree of thoroughness. The mountains here, besides, are high and rugged, with few trails and less feed, so that the more open country and

better climate of the interior has, up to the present, gained most of the attention.

Of the Cache Creek series little can be said; the rocks composing it are chiefly quartzites, dark highly-altered argillites and crystalline limestone, and are supposed to be carboniferous, though no fossils have been found in them in this region, and this classification must be regarded as only provisional. Their extent is very doubtful, and they do not appear to outcrop in the Skeena valley itself, at least as far up as Kispyox; the only locality in the lower part of the Skeena watershed where these rocks were noted being on the Kitsequecla River, a few miles above its mouth. On the Upper Skeena they appear to be more largely represented, as they crop continuously along the river from near the fourth telegraph cabin to the mouth of Bear River, and beyond. The writer is not aware of any claims having been located in these rocks.

The third of these divisions, the Porphyrite group, covers by far the most extensive area, and is also of most interest to mining men, inasmuch as practically all the recent discoveries of mineral occur in this formation, while the coal-measures may, for the present at least, be also included. These rocks are probably of cretaceous age, and vary greatly in composition and appearance throughout the district. While named by Dr. Dawson the "Porphyrite Group" on account of the preponderance of that rock in the Francois Lake district, to the south of the part in question at present; still rocks of volcanic origin are by no means the only ones represented, there apparently having been a gradual change from south to north from beds mainly of volcanic materials to those of purely aqueous deposition.

In and adjacent to the Bulkley valley these rocks cover a great area, and have been studied in more detail than elsewhere, having been prospected more or less thoroughly, and numerous claims located on them. Here volcanic rocks are much in evidence, consisting of porphyrites (andisites), tuffs, agglomerates, etc., often highly amygaloidal with inclusions of calcite, zeolites, epidote, etc., more often occurring in sheets as volcanic flows, but frequently showing evidences of deposition under water, and all more or less regularly bedded. They vary greatly in texture and appearance, in color ranging from light greenish greys to dark purplish reds. Dr. Dawson has estimated their thickness, south of Francois Lake, at about 10,000 feet, and while of necessity this will vary greatly, in the neighborhood of the Bulkley valley it will probably not fall far short of this.

These volcanics have been cut in various places by intrusive granitic areas, which have shattered and metamorphosed them to a great extent. It is along the contacts of these intrusive rocks and the numerous dikes from them with the porphyrites that mineralization has most frequently taken place. The granitic rocks themselves are somewhat variable in appearance, two distinct faces having been noted on the Telkwa River, one consisting of a coarse light colored biotite granite, shading off into a granite porphyry near its edges, and the other of a pinkish syenite porphyry; both, however, seem to have had the same effect in regard to mineralization. The dikes from them show an indefinite number of types.

In the vicinity of the Bulkley there would appear to be, so far as is now known, three main mineral-bearing belts, the most important so far being situated on the Telkwa River, near its head, crossing over into the headwaters of the Morice River. The other two have not been visited by the writer, but from description of prospectors and others conditions there must be very similar to

those on the Telkwa. One of these lies at the head of the Zymætz or Copper River, including Hudson Bay Mountain, and the other is located on the Babine range, between the Bulkley and Babine Lake, near the headwaters of Driftwood Creek. These two latter districts differ from the first-named, inasmuch as a number of galena leads have been located in them, whereas on the Telkwa district that mineral is seldom seen.

On the Telkwa River the ores consist chiefly of copper, and occur in a variety of ways. At times they are found occupying fissures where the country rock has been shattered near the intrusive granite rocks; this is particularly noticeable in Hunter's basin, at the head of Goat Creek. Replacement along crushed zones is another common form of ore deposition, and again in places the later dikes themselves are mineralized, and in other cases, although the dikes appear to be barren, the porphyrites along their contacts are mineralized; one such case, that of the Black Jack and Dominion claims in Dominion basin, which came under the writer's notice, showed a strong dike about 45 feet wide, cutting nearly vertically the porphyrites, themselves dipping at low angles. The brown trap of the dike seemed to be quite barren, but in certain beds of the volcanics, which were more readily decomposed than others, the country rock had been replaced by quartz, calcite, epidote and ore, which alteration appears to have followed the bedding planes, reaching its maximum intensity near the walls of the dike and gradually decreasing laterally from them.

It will be seen from the above that uniformity in the manner of ore deposition is not to be looked for; probably the most common form is when the large dikes are themselves mineralized, especially along their walls. In such instances the adjacent porphyrites are in most cases themselves decomposed in part and more or less mineral-bearing.

Practically no work has been done on any of the Telkwa River properties beyond mere surface prospecting, and that to a very limited extent only, so that it is much too early to prophesy as to their continuity and ultimate value. In some of the small fissures high grade ore is found, with values chiefly in silver and copper (the gold contents as a rule being small), the ore consisting of a variable mixture of chalcopyrite, chalcocite, copper carbonates, bornite and specular iron, the latter at times being highly micaceous. This micaceous iron seems in places to be associated with silver, as a sample of it, carefully separated from the other materials, gave by assay 8 ounces of silver to the ton. The gangue is usually quartz. The following are a few of the most typical claims of this class, the Rainbow, King, Wareseo, Idaho and Russell, all in Hunter's basin.

It is, however, mainly on the larger and lower grade properties that the future of the district depends; the most common ore in these is a mixture of chalcopyrite, a little chalcocite, specular iron and iron pyrites in a gangue consisting of quartz, altered country rock, epidote, calcite, etc., which should make a nearly self-fluxing ore. Among the principal claims of this description may be mentioned the Duchess group, the Evening group, and the Anna-Eva group, all on Howson Creek, and the Dominion and Black Jack claims of Dominion basin.

As a general rule it may be said that, although the greater part of this district is underlain by rocks of the Porphyrite group, no important discoveries of mineral have been made except in the immediate vicinity of the granitic intrusions and the dikes from them, and it would therefore appear conclusive that they were instrumental in the deposition of such ore as has so far been found.

COAL.

Coal has been reported from many widely separated localities in the Skeena watershed, in fact it was known and locations taken up some time before the existence of the metalliferous deposits were noted. To give an idea of the widespread distribution of coal, the following localities may be mentioned where it has been found: The lower part of the Telkwa River and its

tributaries; the headwaters of the northern branches of the Morice River; the Bulkley River, from near its junction with the Morice River to the mouth of Sharp Creek, about twelve miles below Moricetown; Driftwood Creek; the Kitsequeela River, near its mouth; the lower end of the Kispyox River; Tzesatzakwa River; the head of Copper River, and near the head of the Skeena River itself.

In not all of these localities have workable seams been found, but it is of interest to note the presence of the coal-bearing rocks, with the possibility of future work showing up other and better seams in some places at least.

It seems probable that all these coals are at about the same geological horizon, and are of cretaceous age, though towards the south, tertiary coals may be represented contemporaneous with some of the volcanic flow rocks there found, which are in all probability younger than those of the Porphyrite series.

Besides being widely distributed throughout the district, coals differing greatly in quality have been found, as a glance at the following analyses will show:—

No.	Remarks.	Moisture.	Volatile Combustible Matter.	Fixed Carbon.	Ash.
1.	2 foot seam, Driftwood Creek, does not coke.	7.90	36.64	42.06	13.40
2.	2 foot seam, Bulkley River, near mouth of Sharp Creek, cokes well	1.02	25.70	52.96	20.32
3.	Top seam, 10 feet, Cassiar Coal Co., Goat C'k, non-coking; sulphur 0.52%	3.40	28.80	62.00	5.80
4.	6 foot seam, Transcontinental Exploration Syndicate, Goat Cr'k, non-coking, sulphur 0.52%	0.90	9.90	75.80	13.40
5.	6 foot seam, Western Development Co. head of Skeena River, non-coking	5.75	7.34	75.26	11.65
6.	4 foot seam, Telkwa Mining, Milling & Development Company, head of Morice River, non-coking	0.58	10.82	82.70	5.90

Of these coals Nos. 1 and 2 are not likely to be of much economic importance for some time, occurring, as they do, so close to others of better quality; No. 3 is typical of most of the coal on the lower Telkwa, and should make a most excellent fuel for steaming, while Nos. 4, 5 and 6 may be classed as semi-anthracites; they are all strong, bright coals, and should stand transportation well and may some day supply the greater part of the domestic fuel of the Pacific coast cities.

It is to be regretted that none of these coals make a good coke,* No. 2 being the only one that coked well in the laboratory, and it is too high in ash for commercial purposes. In view of the proximity of smelting ores, a good coking coal would be of great value, and it is to be hoped that further exploration will bring to light some suitable seams.

It will be seen from the above analyses that the condition of the coal differs widely at points comparatively near together, and it would appear that the proximity of areas of eruptive rocks younger than the coal-measures has been the chief factor in altering it from a lignitic coal to a semi-anthracite.

Among the better known localities, the Telkwa River field may be mentioned in more detail. Here the coal-bearing rocks overlie those of the Porphyrite group with probably a slight unconformity, but, as they have subsequently been much folded and disturbed, their relationship to one another is not entirely clear. The coal-measures are the highest horizon represented, being

[*Editor's Note.—We wish to take exception to this statement. The usual laboratory tests are not conclusive. Given the proper conditions of comminution and subsequent treatment, many so-called non-coking coals make excellent coke.]

themselves overlain by glacial debris. In a total thickness of not more than 300 feet of measures, four at least, good, workable seams have been uncovered; the intervening beds consisting of clay shales, often highly nodular, with much ironstone, a few beds of soft, crumbly sandstone towards the bottom, and finally a basal bed of coarse loosely-cemented conglomerate, composed chiefly of pebbles from the underlying volcanics.

These rocks must have originally covered a much more extensive area than at present, but their soft nature and consequent inability to resist erosion have resulted in detached remnants only remaining in the valleys. As the valleys are wide, and almost invariably heavily drift-covered, the coal is exposed only where the streams have, in a few places, cut through the deep mantle of gravel to the bed rock; elsewhere no natural exposures are to be found until the higher ridges are reached, consisting of volcanics, the actual contact being everywhere masked. The strata, in addition to this, are much flexed and very subject to faulting, so that it will be readily seen that the task of delimiting the areas and prospecting generally is one of extreme difficulty.

The very small thickness of rocks overlying the coal, and the fact that they are folded in a series of short, rather sharp flexures, and subsequently have been subject to denudation, has resulted at times in the formation of a number of small basins where the seams at no time gain any great depth. It might be possible in such cases to work the coal in a series of open cuts or by stripping the overlying gravel and shales in favorable localities.

Small faults are numerous, and the seams are likewise cut by a number of dikes, usually accompanied by faulting, from the nearby granitic areas.

In regard to the size of the individual seams, the following section was measured at the Cassiar Coal Company's property, on Goat Creek; this is the most complete section to be found anywhere in the district:—

	Feet.
Clay Shales	
Coal with a few small clay partings.....	12.0
Clean coal	7.7
Top Seam	
Clay	2.0
Gray sandy shale and covered, about....	30.0
Coal	1.5
Clay shale	2.7
Middle Seam.....	
Coal with a few irregular clay partings...	14.5
Shale with ironstone nodules	3.3
Coal	2.0
Gray clay shale with nodular ironstone bands, about	50.0
Carbonaceous shale and coal	2.0
Bottom Seam.....	
Coal	1.5
Shale	0.5
Coal with small irregular clay partings....	9.0
Clay shale	—

Several small seams overlie these. A short distance up the creek beyond these exposures the two upper large seams have been burned, leaving thin beds of slaggy material; the overlying clay shales are burned to a brick red, forming a very noticeable feature in the landscape where exposed in a high cut bank. The burnt area, however, does not appear to be of any great extent.

In the Transcontinental Syndicate's openings, a few miles higher up Goat Creek, five seams, 4 feet, 3 feet 3 inches, 4 feet, 6 feet, and 4 feet respectively in thickness were cut in about 130 feet of measures; while on the property of the Telkwa Mining, Milling & Development Company, on the head of the Morice River, at least four seams of the following thicknesses, 4 feet 2 inches, 4½ feet, 4 feet, and 7 feet 3 inches, have been stripped.

Practically all the coal land in this vicinity is controlled by four companies, the three above mentioned and the Kitamat Development Company.

On the Bulkley River, from a short distance above Moricetown to Sharp Creek (about 12 miles), coal outcrops at intervals, but

no workable seams have as yet been uncovered. At Sharp Creek nine small seams were stripped, varying from 15 to 40 inches thick, but they all proved too high in ash to be of value (an analysis of one of these is given above).

Near the head of the Skeena, about 150 miles north of Hazelton, another important coal field is situated, which has been prospected in some detail by the Western Development Company, who control about sixteen square miles of coal lands here. In this field the coal measures occur near the top of a great thickness of sedimentary rocks, which probably represent the porphyrites to the south. The rocks here are not so highly disturbed, and there is apparently a greater thickness of overlying strata than at the Telkwa areas. The coal-bearing rocks occupy the trough of a syncline, with gentle dips on either side, the Skeena cutting diagonally across it. At the southern edge of the basin, however, the strata are much more disturbed, being often tilted at high angles. At least one seam of good coal, from 5½ to 6 feet thick, has been opened up at several places, an analysis of which has already been quoted; other smaller seams are known to exist, and it is quite possible that the larger one does not represent all the workable coal in this area. The physical qualities of this coal are all that could be desired. It is extremely hard, resists weathering well, and is bright and lustrous in appearance. Although no recent volcanic rocks are known of in this neighborhood, still evidences of volcanic action are not wanting, as the rocks of the coal measures and the coal itself are found in places to be cut by small quartz veins, sometimes more or less mineralized with iron pyrites.

In most of the other coal districts mentioned no workable seams have as yet been found, the coal being either too thin or too highly disturbed to be economically worked. Taking into consideration, however, the difficulties of prospecting already alluded to, there is no reason to suppose that larger and more favorably situated seams do not exist, at least in some of the localities in question.

Although placer miners were the first to prospect the Skeena country, the results so far have not been encouraging, Lorne Creek being to-day about the only producing locality. This creek has afforded annually a small output of gold since about 1884.

The Omineca country, to the east, and reached via the Skeena and Hazelton, has long been a producer of placer gold. The old diggings are now nearly all abandoned to Chinamen, but there is said to be a large amount of ground there which can be profitably hydraulicked when transportation facilities have been improved and the cost of working lessened correspondingly. The presence of argentiferous galena in that district has also been known for some years, as well as that somewhat rare mineral, arquerite, a native amalgam of silver, which has been found in the creek gravels.

In the neighborhood of Kitsalas Canon, a number of quartz claims holding gold and copper have been located, but the writer is ignorant as to the conditions prevailing there.

In conclusion, it may be said that lack of transportation facilities has prevented the exploitation of a country rich in possibilities, and until the advent of the railway nothing can be done to open up and develop its latest resources. The present means of communication are highly unsatisfactory, Hazelton, the distributing point, being reached either by pack trail, 400 miles from Quesnel on the Cariboo road, or by river steamer from Port Essington, and as the Skeena is navigable only at certain stages, and then only with difficulty, this route cannot always be depended on. Away from the river, trails are few and bad, and much trail and bridge building will have to be done before even the best known camps are made easily accessible.

The pyroxene group of minerals, found in metamorphic and igneous rocks, are silicates of magnesia with variable proportions of iron, lime and alumina. In this group are angite, enstatite, diopside and hypersthene.

SPECIAL CORRESPONDENCE

NOVA SCOTIA.

The heavy storms occurring at intervals during February interfered, to a considerable extent, with shipments for the month. Notwithstanding, a majority of the larger collieries show increases when compared with the corresponding month of 1906. The Inverness Railway & Coal Company, the Nova Scotia Steel & Coal Company, the Intercolonial Coal Company show substantial increases. The Cumberland Railway & Coal Company, owing to an outbreak of damp, has fallen badly behind in shipments for the past two months; so far behind, indeed, that it will take good work for many future weeks to effect a recovery.

Everyone connected with the coal trade is in good cheer. Prospects never were brighter. The Dominion Coal Company alone has sold close on 1,300,000 tons in Montreal, and an additional hundred thousand or two more could readily have been sold, had the company considered it was in a position to fill the quantity. The Dominion Coal Company are figuring on an increase of half a million tons for 1907. Last year the Intercolonial Coal Company beat all of its former records, and it looks as if the management was determined to make a still better record this year. The quantity shipped last year, 280,000 tons, may not strike the ordinary reader as calling for special comment, but the figures are remarkable when it is considered that the colliery is some two score years old, that its slope is about a mile and a half long, on a pitch of twenty-two, and that the face of the level is a mile or more from the bottom of the slope. It is merry hoisting to bring 1,200 or more boxes along a level and up a slope the long distance specified.

The Province is in excellent cheer over the continued prosperity of the provincial coal trade, and the Premier gave voice to this in bringing down his budget the other day. Royalty on coal is the chief item of revenue of the Province. Last year the revenue from the Mines Department was \$642,000, mostly from coal. The revenue from all sources was \$1,300,000. Premier Murray predicts that in eight years the royalty from coal alone will equal the total revenue of the Province for 1906. In view of these things, Nova Scotians may well be proud of their mineral heritage.

It is generally believed, down this way, that matters looking to a settlement of the Steel-Coal difficulty are progressing satisfactorily, and that a definite arrangement is only a matter of time—a few weeks—perhaps. But a settlement does not mean that the Steel Company will abandon efforts to secure an adequate supply of fuel from its own mines. When the furore was at its height reports were current that the Steel Company had acquired options on territory at Langan, Port Morien, etc. Those in the ken shook their heads and muttered, "this will not do." There were other larger and better areas left out of count, and until the Steel Company sought and obtained options on these they were not in earnest in the matter. That they were in earnest is now made clear by the Steel Company securing options on the Burchell areas at Point Aconi. It is claimed that in these areas there are hundreds of millions of tons. I am content to put the available quantity at seventy-five millions. The areas are submarine, and in order to have easy access to the outlying areas it is necessary to go through an area owned by the Dominion Coal Company. The Government evidently favors granting permission to the Steel Company, as a bill dealing fully with the matter of an entrance to submarine areas has been brought in. A striking feature of the bill is that the Government are the sole judges as to the damages to be allowed the holders of the areas through which an entrance is effected. This bill, however, does not dispose satisfactorily of the whole question of submarine areas. It is this way. A dozen or more years ago few people attached much value to the areas under water. For instance, the General

Mining Association when in operation—though they could have acquired miles seaward—were content with taking up one mile only out from shore. Similarly, the Dominion Coal Company did not see the wisdom of extending their areas at Table Head (Dom. No. 2) more than a mile and a half seaward. At that time it was either considered that the coal did not extend far seaward, or that it could not be profitably mined for more than a mile or two beyond the high water mark. Opinions since then have changed, and it is now believed that mining can be prosecuted under water almost indefinitely. The Nova Scotia Steel & Coal Company took it into its head that it would take up some sea areas in front of the Dominion Coal Company at Table Head, and did so, securing many miles. Then the Dominion Coal Company thought it would pay back in kind, so stalked over to Point Aconi and took out many areas in front of the Nova Scotia Steel Company, and so we have the spectacle of the Steel Company property in front of the Coal Company and preventing extensions seaward, and a similar thing in the case of the Coal Company. There are other companies besides these two which are in similar awkward predicaments. It is suggested that a commission be appointed for the purpose of effecting an amicable exchange of submarine areas, the Dominion Coal Company, for instance, abandoning the areas at Point Aconi, and the Nova Scotia Steel & Coal Company abandoning in turn those at Table Head, the one for the other.

The Miner's Union has made a demand on the Government for the enactment of an eight-hour day, weekly pays, certificates for iron ore miners, and old-age pensions. The Government will be unable to see its way to comply with either of the three first named, but will appoint a commission to enquire into the schemes of old-age pensions in other lands.

It is reported that the Nova Scotia Steel & Coal Company have acquired options on what are held to be extensive iron ore areas at Arisaig, N.S. It is freely predicted that from this out the iron ore trade of Nova Scotia, which has shown little activity for years, will take on vigorous new life. The talk generally is optimistic. Included in this talk is the re-opening of the unlucky Broughton Colliery. It is said a further large sum of money has been obtained in Britain whereby to purchase an area of the Dominion Coal Company which stood in the way of economical developments, and to complete new plans for successfully operating the colliery.

NOVA SCOTIA GOLD MINES.

Moose River District.—The Consolidated Mines Company of Canada, capitalized at \$5,000,000, has been organized to work the amalgamated properties of the G. & K. Mining Company and the Moose River Mining Company. The G. & K. property now has a forty-stamp mill and it is proposed to enlarge this. At present, attention is being devoted to getting a summer's supply of wood, and not much mining is being done. New boilers will shortly be installed, also an air compressor, as they are now getting their air from the Tourquoy Mining Company, which has a water-driven compressor. The company also contemplates developing water power at Scraggy Lake and transmitting it electrically over to the mine.

The Tourquoy Gold Mining Company, under the management of Mr. Robert Kaulback, has been successful in again finding the pay chute in No. 3 belt, which they lost a little more than a year ago. The Britannia belt is also showing good values. The company's dam has been repaired, and sufficient wood has been hauled out to last the summer. There is about 150 tons of ore now in the mine ready to be crushed.

Upper Seal Harbour.—The Dolliver Mountain Mining Company are contemplating the transmission of electrical power from their power plant to outlying mines in Isaac's Harbour.

The Beaver Hat Gold Mining Company, in the same district, are still operating their five-stamp mill.

Cariboo District.—Mr. L. W. Getchell is working the Dixon property. About sixty tons of ore per month are being mined, and, as there is no stamp mill on the property, the ore is hauled to the Baltimore & Nova Scotia Company's mill for treatment. Mr. Fred. Darragh is in charge during Mr. Getchell's absence in the States. A large supply of cordwood has been secured, and a good summer's campaign is expected.

COBALT.

Mr. Rochester, of the Cobalt Lake Mining Company, who was in Ottawa last week, has returned.



A 4-INCH VEIN OF COBALT ORE AT THE EVANS MINE.

Mr. and Mrs. Adler, of the Foster Mining Company, have moved into their new house at the mine.

Mr. J. W. Evans, mining engineer of Cobalt, has taken Mr. J. T. Laidlaw, mining engineer of East Kootenay, B.C., into partnership. The firm will be Evans & Laidlaw, with offices at Larder Lake, Toronto and Cobalt.

Mr. Longwell, of the Coniagas, who has been in New York looking after the company's ore shipments, has returned to town.

Mr. R. W. Leonard, president of the Coniagas, is in town.

Mr. Culbert, of the O'Brien, has left on an extended trip to Mexico.

The McKinley-Darragh-Savage Mining Company have about completed their stamp mill and concentrating plant, and this plant should prove very successful in treating the low grade ores.

The Nipissing Mining Company are pushing the work of development on their veins underground, and have a large quantity of ore blocked out.

The Jack Pot Silver Mining Company have placed an order with the Allis-Chalmers-Bullock Company for a 20 horse-power boiler and hoist, and are opening up their vein adjoining the Nancy-Helen Mine.

At the O'Brien Mine, Manager Culbert is pushing the work on the company's new office and putting in extensive water works for domestic use and fire protection.

The Imperial Cobalt Silver Mining Company, operating near Portage Bay, are installing a three-drill air compressor, a 60 horse-power boiler, and are at present busy erecting a new boiler house. The management expect to have three drills working underground by the end of the month.

The Cobalt Lake Mining Company are getting out some very fine silver ore, and have a quantity already sacked in their ore house which assays \$3,000 per ton in silver. Their new boilers

and machinery are on the way, and Mr. Fraleek, the company's engineer, is getting the foundations prepared and rushing the work of installation. The shaft on vein No. 4 has been sunk to a depth of thirty feet, and the vein shows an average width of nine inches. Five inches of this is niccolite, containing wire silver, and four inches of it calcite, argentite and wire silver, and assays from three to six thousand ounces of silver per ton. On No. 2 vein an open cut is being driven into the bluff, and of five feet. No. 3 vein is solid niccolite from 12 inches to 15 inches in width, and, so far as known, is the largest vein of massive niccolite in the world. So far all of the six veins yet discovered on this property are of practically right angles to the lake, and continue, so far as known, under the lake. Soundings have been taken over three-quarters of the lake, which disclose a clay bottom of from twenty to forty feet thick. This insures the dryness of the shafts and drifts under the lake, and makes the conditions of mining on this property similar to that of the other mines in camp.

Larder Lake is still attracting the attention of the prospector and investor, and many rich samples have been brought down from this interesting district. It will be two months yet before intelligent examinations can be made and any idea arrived at as to the value of the claims already found. One good gold mine would be the making of Larder Lake, but as nine out of every ten claims have been staked on chance, in a depth of snow from two to three feet, little development work has been done as yet.

Numbers of men, with loads of supplies, are going there every day from all parts of the country, and it won't be for want of enterprise or careful prospecting if Larder Lake district does not show up well in summer.

Numerous finds of native silver have been reported to the west of Cobalt. Several finds have been made near Lady Evelyn Lake, and some rich samples have been brought down from them. Native silver is also reported to have been found in James township. This is very significant and shows the silver-bearing area much more extensive than was at first supposed. From a few miles square the area has now expanded to twenty-four miles by about ten miles, or 240 square miles.



SHAFT HOUSE—THE EVANS MINE, NEAR PORTAGE BAY, COBALT DISTRICT.

It is anticipated that more prospecting will be done this summer than any previous year in Cobalt camp.

THE PROSPECTUS OF THE TRUTHFUL JAMES MINING COMPANY.

The directors of this company expect to make ten times their money out of the public, as they do not contemplate putting their own hard-earned money into any mining enterprise. So far the company has two mining properties, for which they paid a total of \$130.

Property No. 1 cost them \$100, and property No. 2 \$30, besides two bottles of whiskey for the embarrassed prospector from whom they bought the claims. Already about \$37 worth of work has been done on property No. 1, at an expenditure of \$480. The directors have also paid \$5 to the mining expert for his report, and have promised to print 5,000 copies of the prospectus as an advertisement for him.

No veins have as yet been discovered on the property, but one fine wall has been found to which a small stringer of smaltite was attached, which one mining expert pronounced calcite, and which, he said, would undoubtedly lead to rich silver values at depth. The property is only 6,559 feet $3\frac{1}{4}$ inches from the Woolly Wonder Mine, whose vein our expert has traced over on our property.

The company has spared no expense in securing the services of Mr. Lieswell, the mining expert, who graduated with honors at Fokerourg in 1837, and who has had 102 years and 3 months' experience in this branch of mining.

We quote the following from our expert's report: "The country rock is a greenish grey calcareous peroxidite, heavily mineralized with hornaceous, schismatic magaphone granite, and is cut by violent intrusions of pink felsnaphic andorite, with rhyolitic inclusions. This gives an abundance of contacts in the property, which will increase in value as they go down. Only one contact is still lacking, and your directors must arrange for that."

In conclusion, our expert states: "This is undoubtedly the finest property I have seen in camp."

We want it clearly understood that we are not responsible for any statements made by our expert; also that none of the directors are putting any of their money into the enterprise, but are relying on the public's money entirely to make it a success.

BRUCE MINES DISTRICT.

Considerable activity is now apparent in the copper mining industry in this neighborhood. During the past few years mining in the district has been in a state of stagnation, but signs are not wanting that a welcome revival has set in. In the past the principal obstacle with which mine owners have had to contend has been the lack of facilities for treating their output on the spot, and the cost of shipping ore to any of the existing smelters in Canada or the United States has proved a considerable handicap to the smaller producers. The prospect, therefore, of custom smelters being erected during the current year at Sault Ste. Marie and Bruce Mines, has given a decided flip to the industry, and renewed energy is evident on most of the properties in the locality. The Bruce Mines were, last year, opened up again, and are now being actively worked with English capital. Operations have been commenced on the Campbell Mine. The Superior Mine, on the Algoma Central Railway, the Northern Ontario Company's property, and the Jury at Dean Lake are being rapidly brought to the producing stage, while negotiations are pending for the opening up of several other rich prospects. An important factor in the success of this district will be the extension of the Bruce Mines & Algoma Railway to the north. At present only eighteen miles of this road have been constructed, viz., from Bruce Mines to Rock Lake. An option has recently been taken, and if, as is projected, the line is pushed on to join the Canadian Pacific Railway's main line, a large tract of rich mineral country, hitherto unexplored, will be opened up. There is abundant evidence that the possibilities of this part of Algoma are becoming apparent to the mining capitalist, and, with the recent influx of English and American capital and the undoubted mineral wealth of the country, everything points to its rapid development into one of the chief copper producing centres of Canada.

The Copper Mining & Smelting Company are preparing to set their concentrating mill at Bruce Mines in motion this spring. Various additions have had to be made, owing to the sale by the former owners of a portion of the machinery, and an order has been placed with the Jenckes Machine Company, of Sherbrooke, for the supply of a 300 horse-power cross compound Corliss

engine, a 75 horse-power slide valve engine for the crushers, and a 40 horse-power engine for hoisting purposes. Satisfactory progress is being made in the production of ore, and the company has now nine drills at work on stopping and development.

ALBERTA.

Last year sixteen new mines were opened in Alberta. Sixty-four are now working. The expenditure through the coal mines department was \$4,500.

It is understood that no more coal lands are to be sold by the Dominion Government. The Government intends holding the lands and leasing them on twenty-one-year leases, at an annual rental of one dollar per acre. No leases are to be issued for less than 2,500 acres, so that, paying this minimum amount rental, a company will have every incentive to early development of its holdings.

BRITISH COLUMBIA.

A. J. Bible was killed at Le Roi Mine, on March 16th, while loosening frozen ore at a dump.

Mr. Thomas Kiddri, well known as a smelter-man, left recently for Prince of Wales Island to superintend construction there.

Much feeling has generated in British Columbia by the recent enforcement of the Lord's Day Observance Act.

The Maple Leaf Mine, in Franklin Camp, B.C., has been sold to Grand Forks and Vancouver parties. Its capitalization is fixed at \$250,000.

MEN AND MATTERS.

On March 9th George Thompson, shift boss at the Trethewey mine, was killed by an explosion of dynamite.

It is stated that options have been secured on the Richardson zinc ore lands in Frontenac county, Ont., and that a smelting and refining plant will be erected in Kingston.

Mr. J. B. Woodworth, formerly manager of the Nova Scotia & Silver Cliff properties, in company with Mr. H. V. Somerville, an English mining engineer, has gone to Mexico for a month.

From Point Aconi, Cape Breton, come reports of progress being made by the Dominion Steel Company in boring for coal in the Burchell areas. The Steel Company has bonded about five hundred acres on the eastern side of Little Bras D'or.

The Edmonton Standard Coal Company, of Edmonton, Alberta, has taken over the Brenton and Parkdale mines.

Shipments of silver-lead ore from the district of Slovan, B.C., increased from 457 tons in December to 509 tons in January.

Legislation has been promised to straighten out the existing unsatisfactory state of the coal and oil licenses in Southeast Kootenay, B.C.

The old Pietou, N.S., copper smelter is to be put in commission again. It has lain idle for some years. The capacity of the furnace is 75 tons of ore per day. The copper ore bodies of Pietou county are yet undeveloped.

PERIODICALS.

The *Mining World* for March 9th begins a new department, "Corporation Affairs and Finances." The issue of March 16th gives a highly instructive article by Dr. R. S. Moss on "The Manufacture of Coke from Western Coal."

The *Mining and Scientific Press* of March 7th contains a well-illustrated and carefully-written article on "Deep Mining in the Lake Superior Region." In an editorial, the *Press* sounds a warning note about Larder Lake.

A description of the "Gold Prince Stamp Mill and Mine," of Animas Forks, Colo., is a leading feature of *Mines and Minerals* for March.

The *Mining Reporter* for February 28th contains a very useful article, "Some Sampling Results," which deals fully with the question of sampling gold reefs.

A very timely description of "The Revival of the Mining Industry in Cornwall" is a special feature of the *Engineering and Mining Journal* of March 9th. Prominent in the issue of March 16th is an outline of works on "The Low Grade Copper Deposits at Ely, Nevada."

The *Colliery Guardian*, London, England, in an editorial on

Professor Lapworth's estimate of Great Britain's coal reserves, remarks that "the visible coal fields, in fact, sink into insignificance in comparison with those which lie buried."

In the London, England, *Iron and Coal Trades Review* of February 22nd is a paper on "Fly-wheel Storage Systems."

The February number of the *Chemical Engineer* gives an interesting account of a peculiar boiler deposit. The first of a series of articles in the electro-chemical problem of the fixation of nitrogen also appears in this number.

The *Canadian Electrical News* presents a very clear paper on "Meter Testing," by Mr. Oliver J. Bushnell.

Hardware and Metal for March 16th has been received. Among other matters, we find a valuable summary of Canadian metal markets.

Other publications received are:—Proceedings of the Cleveland (England) Institution of Engineers, the *Weekly South African Miner*, Bulletin No. 29 of the Institute of Mining and Metallurgy, London; Report of the Ontario Bureau of Mines for 1906, *The British Columbia Mining Exchange*.

The *Maritime Mining Record* of March 13th gives a very complete summary of news and movements in Nova Scotian coal fields.

CATALOGUES AND OTHER PUBLICATIONS RECEIVED

Messrs. Sinclair and Smith, surveyors and engineers, of New Liskeard, Ont., have issued a timely map of Larder Lake district.

THE JOURNAL is indebted to Mr. Harold P. Davis, of Silsby & Davis, New York, for a large blue-print of Coleman township, showing location of mines, etc.

Mussens Limited, of Montreal, Que., are sending out their catalogue, No. 11, which contains descriptions and illustrations of various types of metallurgical machinery. Among the stamp mill supplies we note particularly the Improved Homestake Mortar and the Blanton Self-Tightening Cam.

A folder entitled "Mine-A-Phone" describes the mine telephones manufactured by the Stromburg-Carlson Telephone Manufacturing Company, of Rochester and Chicago.

The Balanced Cable Crane Company, of 135 William street, N.Y., are circulating a fully illustrated catalogue describing their Balanced Cable Crane. They make several strong claims for their crane, among which are the absence of shock and the simultaneous use of any number of motor cars.

A leaflet showing the Campbell Gas Engine and Suction Gas Plant, manufactured in Halifax, England, has been received from the Canadian agents, the Producer Gas Company, of 11 Front street east, Toronto, Ont.

Catalogue No. 10, issued by Mussens Limited, of Montreal, P.Q., contains a list of mine supplies.

In view of the promised development of coal mining in the west, and the increased demand in the East, a catalogue received from the Jeffries Company, of Columbus, Ohio, is of especial interest. That company's devices for loading, unloading and for the general handling of coal and ashes, are admirably modern and complete.

The Allis-Chalmers Company are distributing as a March leaflet a description of their direct current motors and generators, type "K."

Bulletin 142 of the Sturtevant Engineering Series, published by the B. F. Sturtevant Company, of Hyde Park, Mass., illustrates thoroughly their generating sets with compound engines, Class V. C. 6.

DIVIDENDS

The Granby Consolidated Copper Company declared a quarterly dividend of 2 per cent. on March 30th. The dividend amounted to \$405,000.

A dividend of \$28,000 was declared on February 1st by the International Coal & Coke Company, of Coleman, Alberta.

The following companies have declared dividends, payable at the dates and for the total amounts specified:—

Dominion Coal—April 1st, \$150,000.

Nova Scotia Steel—April 15th, \$74,555.

Trethewey—March 15th, \$40,000.

The Bunker Hill & Sullivan Mining & Concentrating Company, B.C., has just paid a dividend amounting to \$180,000. This makes a total, since January 1st of this year of \$360,000.

CANADIAN PATENTS

(Obtained through courtesy of Fetherstonhaugh & Company, patent lawyers, Toronto.)

February 26.—103,776, F. C. Loring, Eastport, Me., hydro-carbon burners; 103,788, H. A. Johnston, Toronto, Ont., internal

combustion engines; 103,801, J. C. Davis, Hinsdale, Ill., process of making castings; 103,831, R. Sugfried, Pittsburg, Pa., flexible connection for gearless motors, Canadian Westinghouse Company, Limited.

March 13.—103,884, G. R. Prowse, Montreal, Que., apparatus for generating and superheating steam; 103,899, F. Von Engelgen & G. O. Seward, Holcomb's Rock, Va., processes of decarbonizing; 103,936, A. Pederson, Cleveland, Ohio, electrically operated portable drills, the Van-Dover Elliott Electric Company.

MARKET REPORTS

LONDON.—Week ending March 9th.—Enquiry for refined copper is far beyond capacity of the suppliers. Electrolytic sells at £118 to £120 net.

Tin.—Operations in tin are quiet. English ingot tin is easy at £195.

Lead is advancing, and a further rise is expected. It is quoted at £20 5s.

Spelter is steady at £26.

Iron and Steel—The market is slightly flat. Pig iron is quoted at 54s. 10d. for Cleveland iron.

Antimony—£98 to £102.

Quicksilver—£7 per bottle.

Silver—31¼d. spot and 31½d. forward.

NEW YORK, March 13th—

Lake Copper—Per lb., 26 cents.

Electrolytic Copper—Per lb., 25½ cents.

Silver—Per ounce, 68¾ cents.

Tin—Per lb., 42¼ cents.

Lead—Per lb., 6 cents.

Spelter—Per lb., 6 9-10 cents.

TORONTO, March 15th—

Pige Iron—Market in good condition. Radnor (charcoal), \$33; Londonderry, \$26; Middlesborough No. 1, \$23.50.

Tin—Steady at 45 cents for ingots.

Copper—Sheet, \$35 per 100 lbs.; ingot, \$27 per 100 lbs.

Lead—Bar, \$5.75 to \$6; sheet, \$7.

Zinc—Foreign, 7½ cents per lb.; domestic, 7 cents per lb.

Antimony—Market strong at 27 cents per lb.

TAILINGS

In nature, cobalt is principally found in combination with arsenic and sulphur.

The residue from the roasting of cobalt ores is called safflor, and is often met with in commerce.

Scribbling paper dipped in melted paraffine wax may be used for indicator drops, instead of porcelain tiles.

Sea water contains not only silver, but gold. The latter metal is present to the extent of about five milligrams to the ton.

Aluminium is much more sonorous than most other metals. Iron and silicon are the chief impurities of commercial aluminium.

The mineral resources of Quebec, only partially developed as yet, include gold, silver, asbestos, mica, chromite, magnetite and feldspar.

A solution containing as little as 0.015 per cent. of cobalt will give a distinct blue color when boiled with strong hydrochloric acid.

Ankerite, or lime-magnesia-iron carbonate, carrying small percentages of manganese carbonate, is mined in Nova Scotia. It is used instead of limestone as a flux in blast furnaces.

Nickel is much more easily reduced than cobalt. Nickel melts more easily. Cobalt fuses at a temperature only a little lower than that at which iron does. In general, cobalt resembles iron; and nickel resembles copper. Both nickel and cobalt have magnetic properties.

The "rescue chamber" is a safety provision of some of the large Austrian mines. It is a strongly-timbered retreat, and its single entrance has a door that can be made tight against air and water by means of rubber fittings. It has three cylinders of oxygen, sufficient to enable thirty men to breathe three days. Inhalation gear is at hand for parties leaving the chamber for reconnaissance or signalling, and canned food, medicines and first aid appliances are also kept in the place. The standard room will accommodate 24 men for a reasonable time for rescue.

The world's platinum is mostly supplied by Russia, but the production has not been keeping pace with the rapidly increasing demand. In consequence the value has nearly quadrupled in fifteen years, having advanced to \$21.00 a ounce—or more than gold—early in 1905, and quite recently to \$34.00 an ounce. Search for new sources of supply has been made, especially in the United States. This has shown that platinum exists in fifteen counties in California, 9 in Oregon, 8 in Idaho, 4 in Colorado, 3 in Washington, 2 in Montana, and one county each in Utah, Arizona and Wyoming. Profitable mining seems to be promised in Southern Oregon and Northern California.