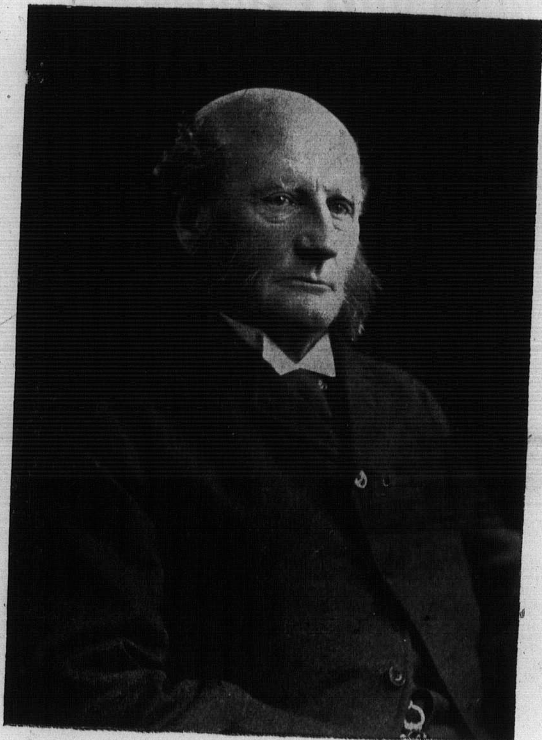
Journal of the General Mining Assoc'n of the Province of Quebec

1891-2-3.

Edited by the Secretary.



Hon. George Irvine, Q.C.,

President, years 1891-2-3.

THE LATE W. HALL IRWIN,

Member of Council.

THE JOURNAL

OF THE

General Mining Association

OF THE

PROVINCE OF QUEBEC.

VOLUME I., 1891-2-3.

EDITED BY THE SECRETARY.

PUBLISHED
AT THE OFFICES OF THE ASSOCIATION
17 VICTORIA CHAMBERS,
OTTAWA, ONT.

The late W. Hale Irwin,
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PREFACE.

Until 1891 no successful effort had been made to secure a general conference of those engaged in mining in the Province of Quebec, and even the attempts to form local organizations had met with but little response. Each miner was apt to look upon his neighbour as a rival, to whom it was not desirable to give information and whose success was rather a cause of envy than an occasion for congratulation. A short-sighted and jealous policy was the rule rather than the exception, and only a few seemed to realize that the prosperity of others in the same line of business would reflect brilliancy upon their own enterprises; and by raising the industry in popular estimation would tend to its general benefit. In this state of things came the Quebec Mining Law, an ill-considered, impracticable and piratical attack upon vested interests. At once a common cause was felt to have been created, and the necessity of some organic form of action was made apparent to all. In response to the energetic call of Mr. B. T. A. Bell, the mining men of the Province met and formed the General Mining Association of the Province of Quebec, which under the able guidance of the Hon. George Irvine, Q.C., successfully combatted the obnoxious law, the Act being repealed on the accession to office of the Conservative Government in 1892. This result alone justifies the existence of the Association; but it is realized that even a greater benefit than the repeal of bad laws may be gained through the exchange of ideas and the personal acquaintance that comes from gathering together at the periodical meetings of the Association. Not only are valuable papers obtained from eminent men of science, but practical miners in the glow of friendly contact give away their cherished methods and hobbies as to working mines and handling products, and they often feel rewarded by receiving similar confidences, and they sometimes learn that they have not held a monopoly of all mining wisdom. They also are led to see that their own success is not hindered by lending a helping hand to their confreres, and they get a useful lesson in the beneficence of co-operation and the practical folly and degrading tendency of an antagonistic competition.

The Association is in no sense a political organization. It does not agitate for the making of laws. It only says to injudicious legislators, "Hands off!" and asks to be let alone. It seeks no subsidies or protection. The mining industry of Canada is the exemplar of the manly, independent enterprise that seeks no profit at the expense of adding burdens to its neighbor's back, but even bears the cost of the imposition of favors to others at its own expense and struggles on unaided only asking for a "fair field and no favor."

If mining is to succeed in Quebec it must be through the economies that are born of knowledge. While mineral wealth exists in abundance, it is so distributed that the discovery is rare of those bonanzas that may be recklessly exploited and yet yield rich returns. The best processes and cheapest methods must be adopted in order to secure enduring operations, and the mutual conference of those interested is the best means of disseminating information and stimulating improvement.

The pleasure arising from association with men of kindred pursuits adds to the profit gained from their ideas; and the "flow of soul" at the banquet that follows the "feast of reason" at the convention unites in friendship those whose interest as well as delight it should be to work in harmony.

It is to be hoped that all who are engaged in mining in this Province will become members of our Association in order to at once benefit by and aid in its efforts to secure freedom from oppressive laws, to increase knowledge of the art of mining, to spread information that shall add to the prosperity of the country and above all to promote that good fellowship which, amidst all the vagaries of mining luck, sustains the spirits and cultivates the charm of human sympathy.

ROBERT C. ADAMS,
Vice-President.

MONTREAL, 23rd December, 1893.

INDEX TO CONTENTS.

INDEX TO PAPERS.

Year 1891-2.

Year 1892-3.

Year 1893-4.

MEETINGS HELD.

23rd January, 1891, to 5th July, 1893.

DATE.		PLACE.	PAGE.
23rd January,	1891	Montreal	1
30th January,	1891	Montreal	3
29th April,	1891	Montreal	11
5th August,	1891	Montreal	72
13th January,	1892	Montreal	75
14th June,	1892	Black Lake and Thetford, Que	133
9th December,	1892	Montreal	165
21st February,	1893	Montreal	171
22nd "	1893	Montreal	193
23rd "	1893	Montreal	194
24th "	1893	Montreal	303
7th April,	1893	Montreal	323
5th July,	1893	Sherbrooke	383

DEPUTATIONS.

DATE.		SUBJECT.	PLACE.	PAGE.
11th February,	1891	Quebec Mining Law	Montreal	8
17th July,	1891	" "	Ottawa	63
31st March,	1892	" "	Quebec	129
4th October,	1892	Quebec Mineral Exhibit	Ottawa	161
7th November,	1892	International Mining Convention.	Quebec	164
11th January,	1893	Tax on Powder Magazines	Quebec	170
9th March,	1893	Duty of Mining Machinery	Ottawa	316

EXCURSIONS.

DATE.		TO	PAGE.
14th June,	1892	Black Lake and Thetford Mines, Que	133
25th February,	1893	Radnor Forges and Grandes Piles, Que	311
13th May,	1893	Lake Memphremagog	

PROCEEDINGS

OF THE

GENERAL MINING ASSOCIATION

OF THE

PROVINCE OF QUEBEC,

FOR THE YEARS 1891-2-3.

SPECIAL MEETING.

MONTREAL.

23RD JANUARY, 1891.

A special meeting of mine owners and operators in the Province of Quebec, was held in the Windsor Hotel, Montreal, on Friday, 23rd January, 1891, to consider proposed legislation affecting the mining industry of the Province. Present:—

Hon. George Irvine, Q.C., President Johnson's Asbestos Co., Quebec; W. H. Irwin and R. T. Hopper, Anglo-Canadian Asbestos Co., Montreal; Capt. Robt. C. Adams, Managing Director, Anglo-Canadian Phosphate Co., Montreal; J. Burley Smith, M.E., Anglo-Continental Guano Works Company, Buckingham; S. H. Fleming, Ottawa; Adolphe Lomer, Messrs. Lomer, Rohr & Co., Montreal; O. M. Harris, Canadian Phosphate Co., Montreal; W. A. Allan, Little Rapids Mining Co., Ottawa; W. T. Gibbs, Dominion Phosphate Co. of London, Buckingham; Geo. R. Forster, Montreal; C. B. Falardeau, Canada Industrial Co., Montreal; B. T. A. Bell, Ottawa; and others.

Capt. R. C. Adams was elected Chairman, and Mr. B. T. A. Bell, Secretary, of the meeting.

THE SECRETARY having read the notice calling them together, the meeting proceeded to consider the new Mining Act introduced in the Quebec Legislature, and to discuss ways and means by which the interests of the mining community might be protected against such a pernicious and retroactive measure.

Mr. A. Lomer suggested that the interests of the owners of phosphate lands and mines might not be identical with those of the asbestos and other mineral industries, inasmuch as the patents for lands might possibly have been issued on a different basis, and if that were so, it might be well that the phosphate men should organize by themselves.

Hon. George Irvine, Q.C., thought their interests were identical. He recommended that they unite into a strong organization. At present, disunited as they were, they could accomplish little and lay no strong claim for consideration by the Government, but this would be otherwise with a well-organized, thoroughly representative, and well equipped association of the mining interests of the Province. He thought the constitutionality of the Act ought to be tested either by appeal to the Federal Government or by action in the courts.

After discussion by Messrs. Franchot, Adams, Lomer, Allan, Forster and others, it was moved by Mr. S. P. Franchot, seconded by Mr. W. H. Irwin :—

Resolved: "That a General Mining Association for the Province of Quebec be now formed."—Carried.

The following resolutions were also adopted without dissent :—

Resolved: "That the following gentlemen be nominated a committee to prepare a draft constitution for said General Mining Association: Hon. George Irvine, Q.C., Johnson's Asbestos Company, Quebec, chairman; B. T. A. Bell, Editor *Canadian Mining Review*, Ottawa, secretary; S. P. Franchot, Ottawa Mining Company, Buckingham; O. M. Harris, Canadian Phosphate Company, Montreal; W. H. Irwin, Anglo-Canadian Asbestos Company, Montreal; J. N. Greenshields, Q.C., Excelsior Copper Company, Montreal; J. B. Smith, Anglo-Continental Guano Works Company, Glen Almond; W. A. Allan, Little Rapids Mining Company, Ottawa; Capt. Robt. C. Adams, Anglo-Canadian Phosphate Company, Montreal; James King, King Bros., Quebec; George E. Forster, Montreal; W. T. Gibbs, Dominion Phosphate Company of London, Buckingham.

Resolved: "That the mining men of the Province, and all interested directly or indirectly in the welfare of its mining industries, be invited to join and co-operate in the work of said Association; and that the secretary be instructed to invite them to a meeting to be held in the Windsor Hotel on Friday, 30th January next, for the purpose of ratifying the Constitution, election of office-bearers and the consideration of recent legislative enactments affecting the welfare of the mining interests of the Province of Quebec."

The meeting then adjourned.

SPECIAL MEETING.

MONTREAL.

FRIDAY, 30TH JANUARY, 1891.

Convened at the Windsor Hotel at three o'clock in the afternoon. Present:

Hon. George Irvine, Q.C., Quebec; S. P. Franchot, Buckingham; J. Lavergne, M.P., Arthabaskaville; Col. Lucke, Sherbrooke; E. Wertheim, Black Lake; John J. Penhale, Black Lake; W. J. Poupore, M.P.P., Ottawa; W. H. Irwin, Montreal; R. T. Hopper, Montreal; O. M. Harris, Montreal; Adolph Lomer, Montreal; R. Prefontaine, M.P., Montreal; W. H. Jeffrey, Richmond; J. L. Wills, Ottawa; A. D. Cameron, Buckingham; William Macintosh, Buckingham; Capt. R. C. Adams, Montreal; Wm. Sclater, Montreal; James King, Quebec; E. Hanson, Montreal; A. W. Stevenson, Montreal; J. B. Smith, Buckingham; F. Hilton Green, Montreal; B. T. A. Bell, Ottawa; and others.

Hon. George Irvine, Q.C., in the chair.

THE SECRETARY read the circular letter and the advertisement calling them together, as well as the Minutes of previous meeting which were confirmed.

THE CHAIRMAN having explained the objects of the Association, invited those who had not done so to come forward and sign the membership roll.

The following gentlemen did so:—

LIST OF ORIGINAL MEMBERS.

John Mooney, Inverness, Que.
E. B. Haycock, Ottawa, Ont.
Hector McRae, Ottawa, Ont.
J. D. Duchàrme, M.E, Montreal, Que.
A. M. Evans, M.E., Black Lake, "
Wm. Sclater, Montreal, Que.
Theo. Doucet, N.P., Montreal, Que.
John M. Jenckes, Sherbrooke, Que.
F. A. Halsey, Sherbrooke, Que.
J. Lavergne, M.P., Arthabaskaville, Que.
Hon. Geo. Irvine, Q.C., Quebec, Que.
J. B. Smith, M.E., Glen Almond, Que.
Capt. R. C. Adams, Montreal, Que.
W. J. Poupore, M.P.P., Ottawa, Ont.
James King, Quebec, Que.
Adolph Lomer, Montreal, Que.
S. P. Franchot, Buckingham, Que.
A. W. Stevenson, C.A., Montreal, Que.

Geo. Stewart, Buckingham, Que.
John J. Penhale, Black Lake, Que.
Dickson Anderson, Montreal, Que.
W. A. Allan, Ottawa, Ont.
S. H. Fleming, Ottawa, Ont.
Ed. Wertheim, Black Lake, Que.
L. A. Klein, Black Lake, Que.
Col. Lucke, Sherbrooke, Que.
Wm. Macintosh, Buckingham, Que.
R. T. Hopper, Montreal, Que.
E. Hanson, Montreal, Que.
W. H. Irwin, Montreal, Que.
A. Cameron, Buckingham, Que.
O. M. Harris, Montreal, Que.
R. Prefontaine, Q.C., M.P., Montreal, Que.
F. Hilton Green, Montreal, Que.
T. W. Williams, Buckingham, Que.
Robt. N. Hall, Q.C., M.P., Sherbrooke. Que.
Capt. Bowie, Ottawa, Ont.
J. Keith Reid, Buckingham, Que.
Taylor McVeity, Ottawa, Ont.
A. F. McIntyre, Q.C., Ottawa, Ont.
B. T. A. Bell, Ottawa, Ont.

Constitution and By-Laws.

The Draft Constitution prepared at previous meeting was read by sections, and, after amendment, adopted as follows:—

NAME.

1. The organization shall be called The General Mining Association of the Province of Quebec.

OBJECT.

2. The objects of the Association will be to mutually benefit and protect its members by facilitating the interchange of knowledge and ideas and by taking concerted action upon all matters affecting or relating to the mining industries of the Province of Quebec, and generally to promote the said industries by all lawful and honourable means.

MEMBERSHIP.

3. The Asssociation shall consist of Members, Associate and Honorary Members.

4. Members shall be persons engaged in the direction and operation of mines and quarries in the Province of Quebec, more particularly mine and mill owners, parties interested in the ownership of mines, mining engineers, mine managers, superintendents and metallurgists.

5. Associate Members shall be persons not eligible in the foregoing clause; but such persons whom the Association shall deem worthy of admission for membership.

6. Honorary Members shall be persons eminent in the profession or history of the industry of the Province.

ELECTION OF MEMBERS.

7. A recommendation for admission according to Form "A" shall be forwarded to the Secretary, and by him laid before the Council. The recom-

mendation shall be in writing and be signed by not fewer than two members of the Association in good standing.

FEES.

8. The membership fee shall be ten dollars (or such amount as may from time to time be determined by the Council) payable annually in advance, at the Annual Meeting of the Association

OFFICE-BEARERS.

9. The Office-Bearers of the Association shall be: 1st, a President; 2nd, four Vice-Presidents; 3rd, a Secretary; 4th, a Treasurer; and nine members in good standing, who shall act with the other office-bearers as a General Council.

DUTIES OF OFFICERS.

10. The President shall be chairman at all meetings at which he shall be present, and in his absence, one of the Vice-Presidents. In the absence of a Vice-President, the members shall elect a Chairman for that meeting.

11. The Treasurer shall hold in trust the uninvested funds of the Association, which shall be deposited in the name of the Association at a bank approved by the Council; he shall receive all moneys, and shall pay all accounts that are properly certified as correct by the Council; and shall present from time to time a statement of the Association's accounts.

12. The Secretary shall attend all meetings, shall take minutes of the proceedings, shall be responsible for the safe custody of all papers, books, and other property of the Association, and, under the direction of the Council, shall conduct the general business of the Association.

MEETINGS.

13. The Annual General Meeting for the election of office-bearers and transaction of the business of the Association, and the reading and discussion of papers, shall be held in the City of Montreal on the last Friday of each year.

14. General Meetings for the reading and discussion of papers, and for the transaction of business shall be held quarterly at such time and place as the Council may determine. Any special business or subject for discussion shall be specified in the notice convening such meetings, and the Secretary shall give not less than fourteen day's notice thereof to all members of the Association.

15. Special Meetings may be called by the President at any time, notice of which shall be mailed by the Secretary to each member of the Association.

CONSULTING OFFICERS.

16. The members in General Meeting assembled shall have power to appoint such Consulting Officers as may be thought desirable from time to time, and may vote them suitable remuneration.

DISSOLUTION.

17. The Association shall not be broken up unless by the vote of two-thirds of the members present at any General Meeting convened for the purpose

of considering the dissolution; and after confirmation by a similar vote at a subsequent meeting, to be held not less than three, or more than six months after the first; and notice of this last meeting shall be duly advertised as the Council or a General Meeting may advise.

Officers and Council 1891.

The following officers for the ensuing year were elected without division:—

President:

Hon. Geo. Irvine, Q.C., Quebec.

Vice-Presidents:

Hon. Geo. Drummond, Montreal.
Capt. R. C. Adams, Montreal.
Robt. N. Hall, Q.C., M.P., Sherbrooke.
R. Prefontaine, Q.C., M.P., Montreal.

Secretary:
B. T. A. Bell, Ottawa.

Treasurer:
A. W. Stevenson, C.A., Montreal.

General Council:

James King, Quebec.
L. A. Klein, Black Lake.
F. J. Falding, Sherbrooke.
Col. Lucke, Sherbrooke.
S. P. Franchot, Buckingham.
W. H. Irwin, Montreal.
A. Lomer, Montreal.
O. M. Harris, Montreal.
J. B. Smith, M.E., Glen Almond.

Honorary Members:

On motion of Capt. R. C. Adams, the following gentlemen were unanimously elected Honorary Members of the Association:—

Rev. Father Laflamme, Quebec.
Dr. A. R. C. Selwyn, Ottawa.
Dr. R. W. Ells, Ottawa.
Sir Wm. Dawson, Montreal.
Dr. T. Sterry Hunt, New York.
Dr. B. J. Harrington, Montreal.

Vote of Thanks to Mr. W. J. Poupore, M.P.P.

On the motion of Mr. S. P. Franchot, a very hearty vote of thanks was conveyed to Mr. W. J. Poupore, M.P.P., for his services in behalf of the mining community, and more particularly for his able and well directed effort in the Provincial Legislature to set aside Government measures affecting the welfare of the industry.

The Quebec Mining Act.

The meeting then proceeded to discuss the Quebec Mining Act.

The Secretary called attention to the presence of reporters, and asked if it was advisable that the deliberations of the meeting should be made public.

Mr. W. H. Irwin, seconded by Mr. E. Wertheim, moved that discussion of the Bill be private.

Capt Adams, seconded by Col. Lucke, moved in amendment, that the proceedings be public.

Capt. Adams' amendment was carried by a two-thirds vote.

The Chairman reviewed at some length, the legal weaknesses and inconsistencies of the Act, and read a Draft Petition which might be submitted to His Excellency, the Governor-General, praying either for an Order-in-Council vetoing the Bill, or an opportunity of arguing their case before the Privy Council.

After discussion by Messrs. Stevenson, Col. Lucke, J. Lavergne, M.P., W. H. Irwin, Ed. Wertheim and others, it was resolved that the Secretary be instructed to communicate with the Hon. Mr. Mercier, and if possible arrange for an interview, the following to be a deputation :—

Hon. Geo. Irvine, Q.C.	Robt. N. Hall, Q.C., M.P.
R. Prefontaine, Q.C.	Capt. R. C. Adams.
Mr. J. Lavergne, M.P.	Mr. James King.
Mr. B. T. A. Bell.	Dr. C. Killing.

The meeting then adjourned.

QUEBEC MINING ACT.

Interview with the Hon. H. Mercier.

11th February, 1891.

Pursuant to resolution adopted at meeting of 30th January, the following deputation held an interview with the Hon. H. Mercier, at the Government Offices, Montreal, Wednesday forenoon, 11th February: Hon. George Irvine, Q.C., Capt. R. C. Adams, Ald. R. Prefontaine, Q.C., M.P., and Mr. B. T. A. Bell; also, Messrs. S. P. Franchot, A. H. Murphy, and Major R. G. Leckie.

Hon. George Irvine reviewed at some length the legal objections to the new mining law, pointing out that it confiscated rights which had been obtained by purchase, and declared all mines to be the property of the Crown, even though the Crown had previously ceded them to individuals for a consideration. Such a revolutionary enactment, he intimated, would in all likelihood, be disallowed by the Dominion Government, but before taking any steps in that direction he desired to call Mr. Mercier's attention to the matter, trusting to his sense of justice to revise the enactment.

Capt. Adams, speaking especially for the phosphate interests, pointed out practical objections to the new law. He said that if the royalty was to be collected by the original purchasers, who had bought lands at low prices from the Government, there could not be much objection, beyond the point raised by Mr. Irvine, that it involved a breach of contract, but in nearly every instance the mines now working, had been purchased at prices varying from $50 up to $1,000 an acre, and these prices had been paid solely on account of the assurance conveyed by the Crown patents that the title gave absolute ownership of the minerals forever. The amount of capital thus invested in the land created a heavy interest charge, and the imposition of a royalty in addition would prove ruinous to some of the less prosperous mines. Already it had checked investment in the industry, and an agent of foreign capitalists in-tending to invest in Canadian phosphate lands had just received a cable recalling him to Europe in consequence of this enactment. He stated that the miners approved of the principle of leasing or selling lands subject to a royalty and with compulsion of working, but would have the terms of acquisition even more favorable, so that the prospector or discoverer might be encouraged to work his finds. He further called attention to the arbitrary powers given to inspectors, and the vexatious nature of the law compelling the erection of fences around pits. The offer of half of the fine to informers, he considered especially demoralizing, and likely to lead to injurious action on the part of discharged or discontented employés. Finally, he objected that the law had been framed without consultation with those engaged in the industries, who understood their requirements, and some parts had evidently been copied from foreign enactments, and were not applicable to prevailing conditions in this country.

MR. B. T. A. BELL, followed, with statements of the injurious effect of the law in checking enterprise. The competition arising from the newly discovered phosphate fields of Florida was already a serious menace, and the imposition of burdens beyond the natural difficulties that had to be encountered would have the effect of discouraging further development of the Canadian phosphate industry.

THE HON. MR. MERCIER stated that he of course desired to avoid inflicting any injury upon the mining industries of the Province. He fully realized the importance of their growth and prosperity; but he must have more revenue, and he only wanted to see how to raise it in the least burdensome manner. He requested that a factum should be prepared stating briefly and succinctly all the points taken against the Bill, and this would be carefully considered by the Ministers in Council, and by the Attorney-General before the law would be enforced. He denied the report that had appeared in the papers that he had refused to receive a deputation of mining men who desired to protest against the passage of the Bill.

MR. FRANCHOT then asked him if it was not true that he had sent a message refusing to receive a delegation, saying that discussion was useless and he was bound to stand by the Bill.

The Hon. Mr. Mercier admitted that he had done so, but that it was only a few days before the third reading of the Bill, when it was too late for discussion. He promised full attention to the representations made, and professed the heartiest interest in the progress of the mining industries.

The delegates agreed to present their suggestions in writing, and retired.

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QUARTERLY MEETING.

MONTREAL.

WINDSOR HOTEL, 29th April, 1891.

The first Quarterly General Meeting of the Association was held in the new club room of the Windsor Hotel, on Wednesday, 29th April, 1891.

The Morning Session opened at eleven o'clock.

Present: A. M. Evans, M.E., King Bros., Black Lake; D. A. Brown, Bell's Asbestos Co., Boston; L. Klein, M.E., American Asbestos Co., Black Lake; John J. Penhale, United Asbestos Co., Black Lake; Richard Penhale, Albert Mines, Capelton; W. H. Irwin and R. T. Hopper, Anglo-Canadian Asbestos Co., Montreal; H. J. Williams, Beaver Asbestos Co., Thetford; C. Koenig and F. Cirkel, Templeton Asbestos Co., Templeton; A. H. Murphy, Thetford Asbestos Co., Thetford; Hon. George Irvine, Q.C., Johnson's Asbestos Co., Quebec; J. Lainson-Wills, F.C.S., General phosphate Corporation, Ottawa; S. P. Franchot, Emerald Phosphate Co., Buckingham; T. P. Bacon, New Rockland Slate Co., Montreal; J. B. Smith, M.E., Anglo-Continental Guano Works Co., Glen Almond; O. M. Harris, Canadian Phosphate Co., Montreal; G. R. Smith, Macgregor Lake Phosphate Co., Templeton; Dr. W. T. Gibbs, Dominion Phosphate Co. of London, Buckingham; F. D. Taylor, M.E., Montreal; W. H. Jeffrey, Richmond; F. Bacon, Park Bros. & Co., Montreal; Prof. Harrington, Montreal; G. W. Schleisinger, M.E., Boston; E. J. Brainard, Hamilton Powder Co., Montreal; F. A. Barr, Edison Electric Co., Toronto; M. D. Barr, Toronto; W. Hamilton-Merritt, M.E., Toronto; J. T. Donald, M.A., Montreal; T. Kirkhouse, Montreal; E. Ward Leonard, Edison Co., New York; J. W. Kirkland, Thomson-Houston Electric Co., Boston; Hector McRae, Ottawa; W. P. Lockwood, St. Francis; B. T. A. Bell, Ottawa; and others. There were also present a number of science students from McGill University.

Hon. Geo. Irvine, Q.C., in the chair.

The minutes of the last meeting were read and confirmed.

NEW MEMBERS.

The following new members were elected:

J. Lainson-Wills, Ottawa; T. M. Williams, Billerica; W. H. Jeffrey, Richmond; W. T. Gibbs, Buckingham; W. P. Lockwood, St. Francis; D. A. Brown, Boston; F. D. Taylor, Montreal; C. Magee, Ottawa, James Cooper, Montreal.

REPORT OF THE COUNCIL ON THE QUEBEC MINING ACT.

HON. GEORGE IRVINE said: Since the last meeting of the Association, the Committee appointed for this purpose took some action with regard to carrying out the intentions of the Association respecting the Mining Act recently passed by the Quebec Legislature. After communicating with Mr. Mercier on the subject, he appointed a meeting with the Committee, and we attended accordingly. Mr. Mercier expressed a desire to look thoroughly into the matter, and asked me to make a statement of my views with regard to the difficulties which existed, and this I promised to do. Owing to the general elections, which took place shortly afterwards, he deferred his departure to Europe, and requested me to send a statement, of which the following is a copy, to the Attorney-General:—

Copy Memorandum on the Quebec Mining Law, Submitted to the Hon. the Attorney-General.

In order to understand the objections on constitutional grounds taken to the recent Mining Law passed by the Legislature of the Province of Quebec, it is important to consider how the law stood previous to the passing of that Act, and what the rights of persons holding mining lands were.

It has always been held that minerals, not being gold and silver, belong to the owner of the soil, and that grants from the Crown in which there is no reserve, convey the ownership in the minerals to the grantee. The course of legislation in this Province and the jurisprudence of our courts fully establishes this.

The first regulations adopted by the Crown Lands Department respecting the sale of mining locations were passed in 1874, and may be found in the report of the Commissioner for that year. These regulations were in force when the Act of 1880 was passed, and a large number of grants were made under it. The lands so granted, except in so far as respects the Royalty or tax imposed by the recent Act are not affected by it.

The Act of 1880 carefully guarded all vested rights—it provided (1422) S. 3: "It shall not be necessary in any Letters Patent for lands granted for agricultural purposes to mention the reserve of mining, which reserve is always supposed to exist under the provisions of this section." The grantees of lots for agricultural purposes whose titles date subsequent to the passing of this Act are guaranteed the right in the event of their discovering minerals on their lots to acquire the right to the full mining property by paying the difference between the price of mining property and what they had paid for an agricultural lot. It will be seen by this that no interference with the rights of property were attempted. The rights of owners of property granted by the Crown were not interfered with, and they remained with their ownership quite undisturbed.

The whole of this existing state of things is changed by the Statute now complained of—Clause 1425, which is substituted for the former clause designated by the corresponding number, enacts: 2. "As it is admitted that mines, whether upon public or private lands, belong to the Crown, any person discovering a mine may purchase the same by complying with the provisions of this section.

It is submitted that no enactment corresponding to this can be found in any legislation heretofore passed by any dependency of the British Empire, still less in the Imperial Parliament, for it not only in a few words takes the property from a large number of Her Majesty's subjects, but falsely asserts that the right to do so was admitted. It would be interesting to find the person who admitted that the Government had the right to take his property from him, and it further seems unnecessary, if it were universally admitted that the baser metals belonged to the Crown and not to the owner of the soil, to pass a Statute altering the existing law, and declaring that such minerals belong to the Crown.

The Statute to which we object then proceeds from Section 1455 to 1512, to provide for the means by which any stranger, on obtaining a permit from the Government, may proceed to expropriate the mine, which happens to be on private lands, and take it away from the proprietor unless the latter chooses to pay the price which may be determined on; the law, however, giving to the proprietor the option of buying his own property if he is willing to submit to this imposition.

It is submitted that this Statute interferes with private rights in such a way as to render its disallowance necessary and constitutional.

(Signed), GEORGE IRVINE,

President General Mining Association
of the Province of Quebec.

QUEBEC, 31st March, 1891.

So far, I think our interview with Mr. Mercier, although it has not yet produced any beneficial results, was satisfactory as far as it went. In the meantime I have drafted a petition containing fuller information than the previous one, praying for the disallowance of this Act, which I will submit to this meeting, and will be glad to make any changes that may be deemed necessary.

THE PETITION TO THE GOVERNOR-GENERAL-IN-COUNCIL.

To His Excellency the Right Honourable Sir Frederick Arthur Stanley, Baron Stanley of Preston, &c., &c., Governor-General of the Dominion of Canada, in Council, Ottawa:

The humble petition of the undersigned proprietors of mining lands, and persons interested in mines in the Province of Quebec, represents:

That there was passed at the last Session of the Legislature of the Province of Quebec, an Act intituled, "An Act to Amend and Consolidate the Mining Law."

That your petitioners respectfully allege that the said Act is unconstitutional, that it has a retroactive effect, that it interferes with private rights unjustly, and confiscates private property, that it is contrary to the policy of the Dominion, and is injurious to a large and increasing commercial industry.

Your petitioners submit to Your Excellency-in-Council the following grounds on which they ask for the disallowance of the said Act:

1. Sub-section 2, of clause 1, repeals the existing law contained in Article 1425, of the Revised Statutes of Quebec, and enacts: "As it is admitted that mines, whether upon public or private lands, belong to the Crown, any person discovering a mine may purchase the same by complying with the provisions of this section." Your petitioners represent that it is not a fact that it was ever admitted that minerals, other than gold and silver, on conceded lands, belonged to the Crown; but that, on the contrary, the whole course of legislation and jurisprudence in the Province of Quebec, as well as the system of administration by the Crown Lands Department of the Province, admitted the contrary to be the case.

2. The Statute complained of proceeds to provide, from section 1455 to 1512, for a system of confiscation of the minerals on private lands; any person desirous of acquiring the minerals on the land of another, obtains from the Government a permit of exploration, and after satisfying himself of the quantity of land which he will require, a surveyor's plan, with an offer of price is deposited with the Commissioner, and unless the proprietor elects to pay the price offered, the property in the minerals passes to the holder of the exploration permit.

3. The Statute law of the Province of Quebec, as it stood previous to the passing of the Act in question, is to be found in the Revised Statutes, from Article 1421 to Article 1582, inclusive, which articles are taken from the Act of 1880, chapter 12.

4. Previous to the passing of this Act the Department of Crown Lands had made regulations for the sale of the Crown Lands containing mineral de-

posits, by which the price of such lands was increased as compared with lands sold for agricultural purposes.

5. Article 1423 provides: "It shall not be necessary in any Letters Patent for lands granted for agricultural purposes, to mention the reserve of mining rights, which reserve is always supposed to exist under the provisions of this section—43-44 V., c. 12, s. 3."

6. Articles 1425, 1428 and 1429 enact: Any person who, previous to the 24th July, 1880, obtained Letters Patent for agricultural purposes, but with reservation by the Government of the mining rights, any lot whatever forming part of the public lands of this Province, may, if he or his legal representative discover and wish to work a mine, purchase the mining rights so reserved by the Government, by paying in cash, to the Commissioner, over and above the price already paid for said lot, a sufficient additional amount to make up the sum of two dollars per acre, if for gold or silver, and one dollar per acre if for copper, iron, lead or other baser metals.—43-44 V., c. 12, s. 4."

Article 1428: "If, on any lot of land granted by Letters Patent since the 9th March, 1878, or which shall hereafter be granted, on the usual terms and conditions, for agricultural purposes, a mine of phosphate of lime has been found to exist, any purchaser of such lot, or his legal representative, shall, if he wish to work such mine, pay in cash to the Commissioner, a sufficient additional amount to make up the sum of two dollars per acre.—43-44 Vic., c. 12, s. 7."

Article 1429: "Every person who may acquire by Letters Patent, on the usual terms and conditions, for agricultural purposes, any lot whatsoever upon which he may discover a mine of baser metals, excepting phosphate of lime, shall, if he or his legal representative wish to work the same, pay to the Commissioner a sufficient additional amount to make up the sum of one dollar per acre.—43-44 V., c. 12, s. 8."

7. The law of 1880 thus carefully leaves the titles of those who held lands under agricultural grants without reservation of minerals untouched, and grants to those in whose grants the minerals had been reserved, as well as to those who had obtained grants since 1880, the right to purchase them on paying the difference between the agricultural and mineral prices.

8. The statute now complained of takes from those whose grants were made previous to 1880 the right of ownership in the mines which had not been reserved by the Crown, and which were their undoubted property, and deprives those who had purchased agricultural lots since 1880, and lands on which phosphates are found, granted since 1878, of the right guaranteed to them by these laws of becoming owner of the minerals by paying the difference in price.

9. The clause 1426 of the Act complained of, imposes on all mineral properties a tax, (therein styled a Royalty), "of three per cent. of the merchantable value of the product of all mines and minerals."

10. The imposition of this tax will be most injurious to the mining interests, and in some cases will entirely prevent the carrying on of mines in those cases where the margin of profit is small, which your petitioners undertake to prove to Your Excellency-in-Council.

11. This action of the Provincial Legislature is contrary to the general policy of the Dominion, as your petitioners believe, the Parliament of Canada having at its session of 1890 granted encouragement to your petitioners by removing the duty on machinery imported for the use of mining operations, which policy is overturned by the imposition of such a tax.

12. That the said Act is *ultra vires* and unconstitutional.

Wherefore your petitioners humbly pray that Your Excellency will be pleased to exercise the power conferred on you by the British North America Act, and disallow the said Bill.

THE CHAIRMAN, in answer to a question by Mr. W. H. Irwin, did not think it necessary to embody details in the petition.

DR. RAYMOND ON THE QUEBEC MINING LAW.

MR. B. T. A BELL then read the following letter from Dr. Rossitter W. Raymond, Secretary of the American Institute of Mining Engineers, New York:

SIR,—I beg to acknowledge with thanks the copy of the new Quebec mining law, which you have kindly forwarded to me. Having but just returned from an absence of several months, principally spent in Egypt or on the ocean I was not acquainted with the provisions of this law, and could scarcely credit the reports concerning them which came in a fragmentary way to my attention.

I have examined, therefore, with curiosity, the printed text of the law; and I confess that my surprise is now greater than ever. I did not deem it possible that the legislature of any civilized country could at this day be induced to enact a measure so barbaric in its injustice and unwisdom. Of the particulars which embody the injustice of the law, the following struck me as the most important, though not the only ones:

1. As I understand it, the law imposes a "royalty" of 3 per cent. of the gross value of the product upon mines already alienated from the Crown by actual sale without any reservation of the right to levy such a royalty. The exact effect of the phrase "unless otherwise determined by letters patent already granted," in paragraph 1426, I may, perhaps fail to appreciate correctly. I

do not know the precise form of such letters patent; and I am led to believe that the form has varied at different times, and in different cases. But it seems clear that under paragraph 1435 of the Quebec law hitherto in force, the right to exact royalty is qualified by the phrase, "unless such royalty be otherwise established by letters patent *or other title from the Crown*," the latter half of which is omitted in the new law. Moreover, that paragraph confines to gold, silver and phosphate of lime the royalty therein specially referred to.

Paragraph 1425 of the old law provides for the purchase of the mining rights expressly reserved by the Government in letters patent granted before July 24, 1880; and the only requisite is a payment of additional sums, sufficient with former payments to make $2 per acre for gold or silver, and $1 per acre for other metals.

Paragraphs 1423, and 1426 to 1434 inclusive, provide similarly for all cases arising under letters patent; and the last named paragraph, together with paragraph 1545, authorises the increase from time to time, by the Lieutenant-Governor in Council, but cannot be construed as affecting the rights of those who had before such increase made the prescribed payment, and in the language of paragraph 1425 *purchased* the mining rights. In other paragraphs, the phrase is sometimes varied, and the right to "work" the mines is mentioned, but without any limitation as to time; and it is impossible to construe the payment per acre, thus provided for, as anything else than a purchase outright, or the tender and acceptance of a lump sum in lieu of all royalty forever.

The new law seems to levy a royalty even upon mines, the rights to which have been legally alienated from the Crown already. I have no doubt that if this be held to be its force, it will stand self-condemned as unconstitutional Such a levy is no longer royalty at all. It is illegal taxation, or rather confiscation. Probably words are wasted in discussing this possible aspect of the case. The courts of a free country may be relied upon to defeat any such formal violation of justice.

But in another aspect the legal remedy may not be so clear; and the view I venture to suggest is therefore offered with le s confidence. Yet it seems clear to me that the land owners coming under the provisions of the old law above cited have certain vested rights, aside from those which they may have acquired by supplementary payments per acre, or by absolute purchase in any other way of the mining rights of the Crown.

The law taken as a whole, embodies the inducements held out by the Government to purchasers of land. One of them is, that the purchaser of agricultural land may, if he find ores of iron, copper, etc., buy for an additional sum per acre the right to such deposits. If he afterwards finds gold, silver, or phosphate, a further payment per acre will buy the right to these also. He is warned by paragraph 1434 that these prices per acre may be increased at any time; by paragraph 1435 that, as to gold, silver and phosphate, he will have to pay royalty unless he has obtained under preceding paragraphs, the "other title from the Crown" therein provided. But he is not warned that the Government may at any time decline to accept any lump sum whatever per acre in lieu of royalty, and enforce a ruinous royalty on mining of all kinds.

Now the question is, whether there is not an implied promise, on the part of the Crown, involved in these provisions on the faith of which, purchasers of lands have acted. Is it not an inducement to the purchaser of agricultural land that if he should find it to contain valuable mines he can buy the mineral right for an additional sum per acre? Or is it not an inducement to the purchaser of iron or copper-bearing lands that he may if phosphate or gold or silver should be discovered in them, buy the right to these for an additional sum per acre? Granted that the Government has reserved the right to increase at any time this sum as to any lands upon which the purchasers' option has not been exercised; granted also, that, under the terms of the law, the Crown remains in possession of the mineral right; yet is it not true that although that right has not been alienated, an option to buy it has been offered as a bonus to the purchaser of other rights?

It must be remembered that the substitution of a royalty, even of a reasonable amount, is not a mere modification of the procedure of a sale, for the purchaser of mineral rights has thereafter the free choice to work the mines or let them lie idle, as he may deem most to his interest. But under the system of royalty contemplated under the new law as universal, the previous purchaser of land is subject to the intrusion of licensed prospectors, and is forced, upon discovery of mineral alleged to be valuable, to work the mines or else let others work them.

I am not now inquiring whether this system would be wise as applied to the administration of Crown lands henceforward; but whether it does not involve a violation of good faith and obligation when applied to the purchasers of lands heretofore. In any such controversy between private parties, the courts would inquire whether the purchaser had performed, in pursuance of the alleged agreement, any acts which he would not have performed in the absence of the inducements offered. The answer to that question in the present case is, I take it, perfectly clear; and the proof will be speedily forthcoming if the new law goes into operation. Capitalists will certainly not wish to buy even agricultural lands to which they cannot somehow obtain a complete title, excluding all private trespass and official interference. Nor will they invest in mining rights held under royalty and subject to forfeiture. Mortgages upon such property will have no value as security; and what will be is only what would have been if the old law had been like the new one in these respects. But the old law held out inducements on the faith of which capital was invested or loaned. Hence, it seems to me, the new law violates an implied contract as to all purchasers of land under the old.

But whether this be legally the case or not, the essential injustice of the new law is plain enough. If it is not unconstitutional, it is unfair.

Aside from these features, the new law is unjust in that it singles out for taxation a particular industry—and the most laborious and precarious of all the productive industries. I do not mean to say that mining skilfully conducted may not be largely profitable; but it would be folly to deny that it presents peculair risks, and that the profits of fortunate and well managed enterprises are offset in the calculation of general results by the cost of much fruitless exploration and many deserved and undeserved failures. The stimulus to industry in this field is the hope of exceptional good fortune. This it is that keeps prospectors at work, and commands a perpetual supply of capital for experiments and developments. Consequently, mining less than any other industry can bear a burden laid equally upon the successful and unsuccessful. Yet this law not only selects mining for special taxation, but practically discriminates against the unfortunate by taxing gross products instead of profits or dividends. I am not now saying that this is foolish and suicidal, but that it is unjust.

I might go on to characterise in a similar way the harrassing restrictions thrown around mining operations under the law, the system of petty official espionage and tyranny ordained by it, etc. But these are part and parcel of the fundamental injustice which it contemplates.

I will add a few observations as to the unwisdom of the law, apart from its injustice. To make this special aspect clear, let us suppose the new system to be applied to Crown lands and their future occupants only. This was the case, for instance, with the Federal mining laws of the United States, of 1866 and 1872. They concerned exclusively the mineral lands of the public domain in certain States and Territories. It is much to be regretted that the Quebec law was not similarly limited. In that case, it would have furnished an interesting, instructive and not disastrous object lesson to the legislators of the province. For they would have seen very quickly that no capital would submit to its vexatious conditions, and no revenue would result to the government.

Who is going to pay for the privilege of exploring for minerals if the owner of the land has the preferential right to take the mine he may develop?

Who is going to make explorations even on his own land, if every pit he digs must be fenced and kept fenced forever?

Who is going to put money into the development of a mine which he cannot allow to lie idle if he finds that it is temporarily unprofitable, or if he gets involved in a lawsuit about way-leaves or damages or boundaries?

Who is going to bind himself to make monthly or quarterly returns of minute business details to a government bureau, or furnish complete maps and descriptions of all workings? It must be remembered here that the law provides for no use to be made of these data, beneficial to the mining industry. It establishes no body of trained and skilful engineers, whose supervision or advice might be really of service. The reports thus exacted will be simply a mine of information for informers, blackmailers, and opposing litigants, and the business of mining under such regulations ceases to be a private enterprise at all.

No doubt some enthusiastic reformers will say that the State ought to work the mines anyhow. We have such people on this side of the line, and perhaps they exist in Quebec; but I need not discuss that proposition here. I will only observe that under the new Quebec law, the State might as well prepare to work such mines as are not now in private hands, for I do not believe that private capital will undertake enterprises in which the public is to be a confidential, irresponsible and meddling partner.

I see that the Premier of Quebec has declared the motive of the law to be the obtaining of increased revenue. It is quite possible that certain concerns now profitable may yield something for a while under this process of squeezing; but unprofitable enterprises will not go on; capital will not be forthcoming for new ones; the goose will lay but one golden egg and then die.

The folly of this scheme as a whole is carried into its minor details. A little acquaintance with mining should convince anybody that three per cent. on gross value would be a very unequal tax on the different substances enumerated. Levied as directed on the gross weight of gold, it would be, on low grade ores, ten or twenty or fifty per cent. of the net profit of the miner; and it would strike a fatal blow at the mining and treatment on a large scale, at small net profit per ton, of the auriferous ores of that class. In fact, the law is so contrived as to rest least heavily upon the miners of rich concentrated materials, who employ proportionally the least labor, and benefit the country least, while it bears most heavily upon those who spend most money in wages, freights and machinery, carry on the most expensive business, and are content with the smallest profits per ton of raw material.

A more ingenious contrivance for injuring a fundamental industry, and with it all the business of the province, it would be difficult to invent.

Of the army of inspectors and informers, and the catalogue of petty offences and fines created by this law, I can hardly speak with patience; and perhaps it does not become me to say much on that subject. We are cursed in the United States with two many officials, and with the evils of too much "patronage" in the hands of our government. Until we get our own civil service, federal, state, and municipal, into a more satisfactory condition, we should not indulge in too free a criticism of our neighbors. I am sorry, in a sympathetic way, to see the people of Quebec exposed to the same evils, and in a form apparently worse than we are called to suffer; but after all, that is their business, not mine. Such citizens of the United States as are not so unfortunate as to be always involved in mining enterprises in the Province of Quebec, will have no cause to complain if this new law goes into effect. They have only to keep their money at home, or invest it in regions more justly and wisely ruled."

(Signed), R. W. RAYMOND.

A vote of thanks to Dr. Raymond for the trouble he had taken to furnish the Association with such an able criticism of the law was unanimously carried.

THE CHAIRMAN said it was desirable that the Association should adopt a resolution authorizing the presentation of the petition to the Governor-General-in-Council praying for the disallowance of the Quebec Mining Act, and suggested that the committee appointed at a former meeting be authorized to present it.—Carried.

NOTE ON THE LAW RESPECTING POWDER MAGAZINES IN THE PROVINCE OF QUEBEC.

THE CHAIRMAN submitted Articles 875 and 876, paragraph 17, Revised Statutes of Quebec, as follows:—

875. Every person keeping a magazine for the storage of powder, or who sells and holds for sale any quantity of powder, must obtain from the Collector of Provincial Revenue a license to that effect.—41 V., c. 3, s. 60; 46 V., c. 6, s. 1.

876. No license can be granted for keeping a powder magazine within the limits of the City of Quebec and Montreal, or within a radius of five miles therefrom, or unless the building be erected according to the following rules:

1. Every magazine shall be built of stone, at least two feet in thickness, covered with a fire-proof roof, made of metal, and adhering to the building by its own weight only.

2. It shall be enclosed, at a distance of at least ten feet clear, by a stone or brick wall at least ten feet high, with a stone coping having a single opening of which the door shall be covered with brass, copper or zinc, and shall be so placed as not to open on any public highway, or on the side on which is the door of the magazine.

3. In the construction of the magazine or in the surrounding wall, only stone, brick, copper, brass, wood, glass, tin, slate, zinc, or leather can be used.

4. It must have but one entrance, to which two doors with copper fastenings shall be placed, one inside and one outside the wall; both made of brass, copper or zinc, or covered with the same material.

5. The floors shall be tongued and grooved and close-jointed, and each part thereof on which any person might walk or place his foot shall be covered with leather.

6. It shall be provided with two lightning rods, to be approved of by the Collector of Provincial Revenue.

Any powder magazine may, with the consent of the Lieutenant-Governor-in-Council, be constructed in a different manner.—41 V., c. 3, s. 61; 46 V., c. 6, s. 1.

THE CHAIRMAN said: We all know the importance of taking such precautions as will render the powder magazines, which are an essential part in all mining operations, safe for the public and for the people who use them. We have on this subject a law which is apparently a good one. We have in Articles 875 and 876 of the Statutes a provision which lays down, so far as regards the Cities of of Quebec and Montreal and their immediate neighborhoods, a rule for a special magazine constructed in a particular way—special directions as to the kind of magazine that is required. It also requires that every one in other parts of the Province who have magazines, whether such are required either for the use of the person to whom they belong, or for storage purposes, that a license should be obtained from the Provincial Government, and a plan or specification of the magazines proposed to be built furnished to the Provincial Secretary. If the magazines are approved, the Government issues a license, the tax being $150. These are the existing regulations on the subject. I cannot say that it is desirable in the interests of mining companies, or the persons owning the magazines, that this law should be strictly complied with. It does not at all follow in the event of its not being complied with, that because an accident occurs, the owner of the magazine is liable for such accident unless it can be shown that the accident occurred through some neglect of the owner of the magazine. Besides that, if a license has not been applied for, and a magazine is kept without such license, the owner is liable to a penalty provided for in the Act. I am of the impression that this law is not being complied with at all; it may be in some places, but I am quite sure that there are a very large number of cases where this law has been disregarded. I had myself a plan of a magazine recently prepared, which I have sent in to the Gov ernment, and have reason to believe they will adopt it. It is stated by those who profess to understand something about the matter to be a safe kind of a magazine, and not by any means an expensive one. It is satisfactory to know that much. I may say that it will strike every person present as being most desirable in their own interest that the laws should be followed out. A plan of the magazine should be submitted to the Provincial Secretary, and a license obtained, because in the event of an accident occurring, although it might not absolutely relieve the owner of the magazine from all responsibility, notwithstanding the fact that he has had the plan of his magazine approved of and obtained the Government's sanction, it would undoubtedly be a very strong point in his favor. I commend it strongly to the consideration of all gentlemen who have powder magazines, and who are interested in the subject.

MR. W. H. IRWIN—I understand that the new Mining Act does not specify the class of magazine that is to be used.

THE CHAIRMAN—The new Mining Act does not touch the magazines at all.

MR. L. A. KLEIN—What I am afraid of is this: If the license will be raised say to $150 and expensive magazines be put up, this will induce the mine owners to put up one general magazine and keep a lot of material together, which, I think, would increase the danger.

MR. W. H. IRWIN—Every mine owner is as careful as possible. Take our own district—during the time we have worked there we have not had one single accident, except last year, when we had a blow-up from lightning. No magazine will prevent that, and now we keep our material at two or more different places to avoid danger. Now if a high license be placed on our magazines, all the miners will join together and probably keep a large quantity of dualin in the one magazine, which will be more dangerous than at present. He asked whether it would be contrary to the law for several mine owners, as Mr. Klein suggested, to join together and erect a large magazine for the purpose of keeping their stores therein.? He thought the object of the Quebec Government was to derive revenue from this license, and that it might be a violation of the Act, inasmuch as half a dozen different companies would only pay one license of $150 in lieu of several.

Mr. L. A. Klein thought that it would not be necessary for the mine owners to do that. The suppliers would put up the magazine and the mine owners would buy their explosives daily. Nothing could prevent that and the Government would get the $150 license fee and twenty thousand tons might be stored there.

The Chairman remarked that the mines of the asbestos district were within a comparatively small circuit, and there would be no great inconvenience in keeping their explosives in one magazine.

Mr. W. H. Irwin said that so far as the convenience of the miners was concerned, he thought it would be a great advantage over the present system, but at the same time the Quebec Government would consider that an evasion of the Act so far as it related to the license and the revenue to be derived.

Mr. A. M. Evans remarked that the law of taxation would be all right if a man were to go to Thetford and put up a powder magazine for the purpose of selling that powder to miners, but the law has no right to tax the individual miner. It might as well tax him for his bread and cheese.

The Chairman, in answer to a question, stated that a magazine of the kind he had submitted to the Government would not cost more than $500 or $600.

Mr. W. H. Irwin stated that last year their magazine was struck by lightning and that had it been built according to the plans suggested in the Act not only would the magazine have been blown to pieces, but being of stone and solid material would have done a great deal of damage. Their magazine was a wooden building on the top of a mountain and practically no damage was done.

The Chairman stated that the kind of magazine suggested was more for preventing explosion than for considering what the effect of an explosion would be if it took place.

The Responsibilities of the Mine Manager.

This subject was ably handled in an address by Mr. A. M. Evans, M.E., Black Lake. Mr. Evans touched upon (1) The responsibilities to ourselves; (2) The responsibilities to our employers; (3) The responsibilities to our employés. He spoke strongly in favor of greater educational facilities for the miner, and advocated closer attention to sanitation in mining settlements.

An Invitation to Visit McGill University.

PROF. B. J. HARRINGTON, on behalf of Sir William Dawson, invited the members to visit the Redpath Museum, and to attend the Convocation of the Faculties of Arts, Law and Applied Science, to be held in the Windsor Hall on Thursday.

Mining Bureaus.

Mr. W. HAMILTON MERRITT, F.G.S, Toronto, having been called upon to address the meeting, said: I received with great pleasure the kind invitation of this Association to attend your first quarterly general meeting, and as it came at a time when we were endeavoring to interest the people of Ontario in mining matters, I felt it important that I should be here to attend what I consider an extremely important event. I hope that we in Ontario will be able to follow your example and form a similar association, because I am confident that anyone who has the interest of mining development at heart, must have come to the conclusion that combined effort is absolutely necessary in order to obtain that measure of recognition from the Government which the status of the industry and the extent of our mineral resources warrants. He commented on the recent Mining Bill introduced at the last session of the Ontario Government, pointing out the absurdity of having the operations of the Mining Act controlled and directed by the Department of Agriculture. He also advocated a closer recognition of commercial data by the Dominion Government, either in the present Bureau of Mining Statistics in connection with the Geological Survey, or elsewhere.

MR. B. T. A. BELL pointed out the utter inefficiency and incompetency of the so-called Mining Bureau, attached to the Department of Crown Lands in Quebec, stating that until the Government consulted with trained and experienced mining inspectors, well versed in the wants and uses of the industry, it was hopeless to expect proper mining legislation. If the local Government had followed the example of the Province of Ontario, and appointed a competent Commission to enquire into the requirements of the industry, he was sure no such iniquitous measure as the recent Quebec Mining Act would ever have been attempted. The Dominion Government had done much to foster our manufactures, to extend colonization, to build railways, to develop our great agricultural resources,—what had it done to promote the most staple industry of them all, the development of our mines? The Geological Survey, it is true, had accomplished much, and deserved a more generous recognition. It must, however, be regarded in the main as a scientific institution. Was there not an urgent demand for some department or section of a department where commercial data would be readily accessible? The present Statistical Bureau operated by the Survey was practically useless as a means of supplying that commercial information respecting our minerals so much sought after by investors from other countries.

Mr. W. H. Irwin—I quite agree with Mr. Bell that this matter should be taken up by the Province, and that there should be established a proper bureau of mines, whose duty it would be to supply the public and miners with information bearing upon mining affairs. Of course, heretofore, the answer to that would have been, I suppose, that the mining community did not contribute sufficient revenue to warrant the expenditure. But as it seems to be the intention of the Provincial Government to tax mining property in some form or other, I think now is the time to bring the matter to official notice. He moved that the Secretary be empowered to prepare a resolution to be submitted to the Quebec Government.—Carried.

This terminated the morning session.

AFTERNOON SESSION.

The afternoon session opened at three o'clock. The following papers were presented :—

THE CHEMICAL COMPOSITION OF ASBESTOS.

By J. T. Donald, M.A., Montreal.

Having of late devoted some time to the analysis of samples of asbestos from different localities, I have decided to lay before you some of the results obtained. These, I trust may be of interest both to those who are engaged in mining in the asbestos districts of Eastern Quebec, as well as to those whose labours are among the Laurentian rocks. I shall confine my attention to three points :—

1. *Comparison of Canadian with Italian Asbestos*—When Canadian asbestos was first placed upon the market it had to compete with the Italian mineral, and it is matter for regret that attempts were made to decry the Canadian article and to prejudice users by the statement that chemical analysis showed the latter to be inferior to the Italian. From different sources samples of the Italian were procured, some of which are now before you. An analysis was made of the best sample and the results are shown in column 1. Column 2 shows the composition of a sample from Broughton. The Broughton fibre was taken for analysis because of its marked freedom from foreign matter, the Thetford samples first selected for that purpose having been damaged by fire and smoke.

	Italian.	*Broughton.*	*Templeton.*
Silica	40·30	40·57	40·52
Magnesia	43·37	41·50	42·05
Ferrous oxide	·87	2·81	1·97
Alumina	2·27	·90	2·10
Water	13·72	13·55	13·46
	100·53	99.33	100.10

Certainly chemical analysis shows that our Canadian fibre is in no wise inferior to its European rival.

2. *The Cause of the Harshness of Fibre of Some Asbestos*—Chemical analysis throws light upon this important point. From the analysis given above it may be seen that asbestos is principally a hydrous silicate of magnesia, *i.e.*, silicate of magnesia combined with water. It must be borne in mind that this water is not present as moisture, the moisture of bread for example, which can be driven off at a temperature of 212° Fah.; it is water more intimately associated with the silicate, but which may be dissociated therefrom and driven off by a high temperature, just how high I have not yet determined.

When harsh fibre is analysed we find it to contain less water than the soft fibre. In fibre of very fine quality from Black Lake, analysis showed 14·38 per cent. of water, whilst a harsh-fibred sample gave only 11.70 per cent. It is well known that if soft fibre be heated to a temperature that will drive off a portion of the combined water there results a substance so brittle that it may be crumbled between thumb and finger. There is evidently some connection between the consistency of the fibre and the amount of water in its composition. It is probable that the harsh fibre was, as originally deposited, soft and flexible, and has been rendered harsh by having a portion of its water driven off by heat, either produced by movement of the associated rocks or resulting from the infection of molten matter through volcanic action.

3. *Comparison of Cambrian with Laurentian Asbestos*—Up to the present time Canadian asbestos may be said to have been obtained exclusively from the Cambrian rocks of Eastern Canada. Of late, however, indications have not been wanting to show that it is possible that the great belt of Laurentian rocks to the north of the St. Lawrence may yet prove to be a rich source of this mineral. It has long been known that seams of short fibre are to be found in those rocks, but it is only within the last year that any attempts have been made to test these veins; and it is gratifying to be able to state that the results of these attempts are promising. Much of the Laurentian serpentine is different from that of Thetford and

Black Lake. It is much lighter in color and is remarkably free from disseminated chromic and magnetic iron. The contained asbestos is, like the serpentine, of a lighter color than that from the Cambrian, and in consequence of the absence of iron there is little or no tendency to discoloration from percolating water. Is this Laurentian asbestos as suitable for use in the arts as is the Cambrian variety? Column 3 in the table gives the analysis of a sample from the Laurentian of Templeton, from which it is seen that so far as composition is concerned the two are practically of equal value.

In conclusion your attention is directed to the specimens before you. The world is being searched for asbestos, particular attention being paid to South Africa, which is considered a promising field. These specimens are said to be fairly representative of their localities, and it requires no expert to recognize the great superiority of the Canadian mineral.

DISCUSSION.

Mr. L. A. Klein pointed out that the only objection to Italian asbestos was that it did not stand spinning so well. He thought that Mr. Donald's sample could hardly be characterised as a fair specimen.

Mr. W. H. Irwin pointed out that to-day Canadian asbestos is used in every country in Europe for manufacturing purposes, even at the pit's mouth of the Italian mines. As Mr. Donald has explained, there is very little difference between the Canadian and Italian asbestos as to their composition, but there is a very great difference in their formation. The Italian asbestos is exceedingly long in fibre but it is in such a shape that it is almost impossible to handle it properly with machinery, while Canadian asbestos costs so much less to manipulate, and allows it to be placed in the market in its manufactured shape at a price that will enable it to compete with any other asbestos material.

Mr. A. M. Evans inquired whether the formation of asbestos actually rises with the contour of the ground or whether it assumes its own level. He knew for a fact that on a level with Black Lake they had asbestos, and that 750 feet above, at Mr. Klein's place, they also had asbestos, and he asked whether Mr Klein would be right in supposing that he had 750 feet of asbestos. This was a question for mining men in the future to take up.

Mr. B. T. A. Bell asked if it might not be in the interests of the industry to have the occurrence of the mineral tested by the diamond drill at depth.

Mr. W. H. Irwin said that as asbestos altered in character every few feet, a bore-hole might not be a fair test.

Mr. J. Lainson-Wills, speaking of the Italian and Canadian asbestos, said he did not know whether the analysis as given by Mr. Donald represented the average composition of these separate minerals. They all knew that they are separate minerals, the Italian being fibrous serpentine, whereas the Canadian is fibrous only. There seems to be too much similarity between the minerals which are really different.

MINE INSPECTION.

By Mr. J. Burley Smith, M.E., Glen Almond. Que.

Naturally assuming that this paper should deal with the inspection of mines in accordance with the mining laws and regulations of the Province of Quebec, and the recently passed amendments to the Mining Act, I found on consideration of these that they are not mining laws in the proper sense of the term, at least as understood among mining men in Europe, and that it is difficult to anticipate by the light of mining experience merely the effect of enactments which should more properly be considered from a politico-economical point of view.

The recent amendment to the Mining Act referred to concerns itself almost entirely with the sale and purchase of mineral lands and rights, and the imposition of a heavy and direct tax on the produce of all mines, and has for its object so undoubtedly the acquisition of revenue, that I hesitate to speak on the question at all from a miner's point of view, knowing little of the duties of mine inspection under such conditions, and knowing less of the effect of arbitrary laws which invest an inspector—who, from the responsible and delicate nature of his office, ought never to be more than a witness—with power to assess and collect taxes and impose penalties, and, with the summary jurisdiction of a police magistrate, to enforce them.

The tendency in the older mining countries of Europe, especially Great Britain, has been of late years towards the reduction, if not total extinction, of royalties, dues, and such impositions, and the appointment of a Government inspector to collect these would, there at least, meet with very determined opposition.

We may, I think, take it for granted on general principles of economy that the less interference there is by the State with a young and promising industry the better for both State and people.

It would be considered monstrous if the Government were to impose a tax on the production of any staple article of food, say wheat for instance, yet a direct tax is levied on the mineral known as phosphate of lime, the sole use of which is for fertilizing the land, and which is the great plant food of the cereal of which bread is made. Is not this a tax on the production of food?

Enormous tracts of land in the Province of Quebec are lying exhausted and unproductive at the present time, actually incapable of growing wheat for want of a fertilizer, and yet a heavy tax is imposed on this mineral, already costly and difficult to mine—a fertilizer capable of reviving the wasted energies of the Province, and enabling her farmers to grow enough corn to supply the wants of a much increased population to say nothing of export.

Perhaps no known industry is so likely to produce general prosperity in a new country as that of mining. It always attracts an energetic and useful population, and the best promise of revenue is to let such an industry develop itself without hindrance and with as little interference as possible.

Colonies rapidly become settled in the neighborhood of mines, and a demand rapidly springs up for agricultural and other home produce, thus offering the surest guarantee of permanent prosperity to the whole country. Is it a wise policy for a country rich in minerals to hamper this industry with taxes and a complicated system of purchase, and harass those engaged in developing it with the troublesome interference of inspectors and the miserable espionage of informers, the latter of whom will certainly increase in proportion to the penalties of which they are to receive half for their information?

The laws and consequent inspection which are really beneficial to mines and miners, however, are those which control the actual working or operation of mining, and the conditions existing between owners and workmen, in order that the former may not derive profit regardless of the safety and health of the employees, and that the latter may not wrong themselves through the neglect of sanitary laws and the careless indifference to danger engendered by custom and familiarity.

In recent times the object of mining legislation in European countries has been almost entirely in the direction of ameliorating the condition of the workers. By regulating the hours of labour, by preventing the employment of women entirely, and children of tender years underground at all, and by the prevention of accidents, through the close and regular inspection of underground workings by competent mining engineers; and such inspection has led to other benefical regulations from time to time.

The passing of the Metalliferous Mines Amendment Act of Great Britain, in 1872, was the result of a great number of reports made from time to time by the inspectors themselves, showing the inefficiency of the existing laws to insure proper conditions of mining.

The inspectors prior to that time were, as a rule, fairly well educated engineers, though not to compare with the class of mining inspectors of the present day. They were generally practical miners, and men sensible of the high responsibility of their office. In their experience in the general inspection of mines they were brought face to face with a state of things which, at that time, it was not within their power to improve according to existing laws, and I think we have to thank them for the better laws enacted as the result of their reports and recommendations.

The laws, however, which they were indirectly instrumental in making, demanded a much more highly educated class of men to see the regulations enforced, and inaugurated a new epoch in the history of mining in Great Britain.

These Government inspectorships of mining divisions under the new Act were very properly lucrative and honorable appointments; young mining engineers were specially educated at the French, German and English mining schools with a view to obtaining them; many of them had actual experience in the working of mines in several of these countries.

The result of this was to raise the standard of mine engineering in Great Britain in a marked degree. By the light and application of scientific knowledge to mining it has become a more certain and regular pursuit. A mining inspector of the present day is at once an engineer, a geologist, chemist and mineralogist. The competitive examination system in England, insures the selection of the very best men of their class. Their knowledge is communicated to mine managers and in a great measure to the workmen by advice tendered in the intercourse which their close and frequent inspection necessitates. The visit of the inspector is rather hailed with pleasure than otherwise, and under this judicious system inspection cannot be considered domiciliary or in the light of espionage.

The owners of mines feel that useful regulations and close inspection secure a good system of mining, and relieves them of much responsibility.

The manager or agent feels himself also relieved of much personal responsibility in the case of unavoidable accidents.

The penalties imposed for violation of the laws are frequently applied to the relief of the sufferers of mine accidents.

In Canadian mines, perhaps more than anywhere else, mining in spection is urgently needed, not in the sense understood with regard to the recent mining law of Quebec, but for the proper working of its minerals and the prevention of accidents to the workmen.

In this paper I am not referring to coal mines, which usually need special regulations and special supervision, but to such mines and quarries as come under the provisions of metalliferous mining laws.

The sudden changes in such a climate from severe frost, where masses of loose rock and dangerous ground may be held together safely enough in winter, and break away with disastrous consequences in summer, necessitates careful timbering. It is evident that if this is left to the option of the owners or agents, the question of safety will, in a great measure, be subservient to that of economy.

In order to see that mining operations are properly carried out, underground surveys should be made compulsory after a certain stage of development, and the duty of the inspector should be to see that such surveys are completed and filled in up to a fairly recent date, showing the addition to such plans of the latest workings. Such surveys are necessary also to prevent the encroachment of neighboring mines on each other's property, and for this purpose should have reference to a surface survey of the country, which should be made by the usual sworn surveyors. Copies of such survey should be deposited at the Record Office of the Province, together with other information supplied by the inspectors. Such records afford valuable assistance to subsequent mining and to the geologists of the country.

The storage of explosives on or about a mine would also come under the authority of the inspector of mines, as well as the quantity allowed to be carried into the mine for immediate use by workmen.

With respect to magazines for storage of explosives, considerable latitude should be given in a country but unequally settled like Canada.

The expensive magazine needed in a thickly populated neighborhood would be superfluous for a new mine opened in a district which is unsettled and but sparsely inhabited. It should not be overlooked either that great difference of opinion exists among scientific experts on this subject of magazines, and that while some recommend costly and elaborate buildings, heavily built and ponderous, others advise the lightest and most fragile of structures, and it is certain that in the event of a magazine explosion the result would be much more dangerous in the former than the latter.

Special rules and supervision are desirable too with regard to the charging and firing of blast holes, having particular reference to the kind of explosive material used.

Also for the securing safe means of ascent or descent of persons in the mines by ladders, and the angle at which they should be placed, with proper provision for resting at convenient stages where the mines are deep.

To secure the good health of the workmen it should be incumbent on the owners of mines to provide a proper system of ventilation, the noxious fumes of after-damp being the insiduous cause of many terrible diseases.

I do not purpose in this paper to supply a code of rules for the working of mines in this Province, and have merely given the foregoing as examples of such a code as could be usefully formulated to the advantage of both owners and employees in this country.

And in all mining countries the owner or agent of mining works should have a right to establish special rules, which may be desirable for the conduct and guidance of the persons employed, after submitting the same to the inspector of his division for approval and the consent of his department.

In conclusion it may be worth while to notice that in older mining countries arbitrary powers to fine and imprison without appeal are never given to inspectors—a system which it is evident, whenever employed, will lead to bribery and corruption.

In England, the inspector is never invested with the powers of a justice of the peace—his duty being to report any violation of the mining laws, and prosecute if necessary.

In cases of arbitration, having regard to a dispute as to the violation of the rules, or as to whether it is a violation, the inspector of mines should be considered as one party to the arbitration, and the mine owner or agent as the other, and an umpire should be decided on in the ordinary manner.

In England the cases of prosecution are taken by the inspector before a magistrate of quarter-sessions.

I regret that I have not had time to do greater justice to this subject as it is a very interesting one to me.

Its consideration has, however, suggested many things in connection with Canadian mining laws and inspection, which I hope to be able to refer to again at some future time.

Meantime, if anything I have said leads to a discussion amongst the many eminent mining men present here to-day, the best object of such a paper will be fulfilled.

DISCUSSION.

Mr. W. H. Irwin, in referring to Mr. Smith's paper, thought it to be greatly in the interest of the mine owner to have proper mine inspection. In the asbestos district they had an inspector well acquainted with the wants of the community, and although not a scientific or practical miner, thoroughly honorable and trustworthy. He referred to Mr. John White.

The Chairman—It was undoubtedly a great advantage to know that they were working under the inspection and sanction of a man who thoroughly understood mining work. In the event of any accident the mine operator needs a competent witness in the inspector to bring be fore the court.

Mr. B. T. A. Bell—It is a notorious fact that in this Province no official record is kept of accidents and no enquiry or report is made regarding them by the present so-called Mining Service of the Government. During the past year there had been falls of roof and slides in different parts of the country, fortunately without loss of life, the mishaps having occurred when the men were out of the pits. It was the duty of the inspector to have examined and condemned these workings.

The protection of the employee was the best safeguard to the employer. He thought the Association would be remiss in its duty if it did not make some representation to the Government on the subject.

MR. A. M. EVANS—In England, in 1862, for every 12,000 tons of coal raised, they would kill a man, and after the Goverment took over the matter in 1870, 40,000 tons were raised without any fatality. If the record of that country be taken to-day, as compared with 1870, he believed that the district of Lancashire can produce 50,000 tons without any death from accident. Such was not the case before Government inspection was introduced.

MR. A. W. STEVENSON thought the subject one of urgent importance, and he would move, "That the President, Mr. L. A. Klein, Mr. S. P. Franchot, and the Secretary, be a deputation to confer with the Government on the subject."—Carried.

Visit to McGill University.

At the invitation of the Edison Electric Company, the members took carriages and drove to McGill University Grounds, where a Marvin Electric Percussion Drill and the necessary plant had been installed. Before examining the plant, the party adjourned to one of the lecture rooms to listen to the papers on the application of electricity to mining operations. The first subject was:—

THE ELECTRICAL TRANSMISSION AND CONVERSION OF ENERGY FOR MINING OPERATIONS.

By H. Ward Leonard, New York.

The transmission and conversion of energy is, above all others, the question of importance in every kind of engineering work, and in mining engineering this is most conspicuously true.

Until quite recently all practical methods of transmitting and converting energy involved the actual transfer of sensible matter over the distance in question and this matter necessarily possessed such qualities as weight, magnitude, temperature, inertia, and other qualities common to all matter.

It is, therefore, not surprising that all engineers, and particularly mining engineers, are watching with the keenest interest, the development of methods for transmitting and converting energy by means of electricity, for, in electrical problems, the many considerations and restrictions due to the inflexible characteristics of matter may be entirely disregarded and the possibilities of mining engineering are correspondingly increased.

The transmission and conversion of energy by water, steam, cables, compressed air, and so forth, we are all familiar with, and we know to our sorrow, the limited distance, the low efficiency or the tremendous first cost which has hampered our engineering work at every turn.

With the utilization of electricity for the transmission and conversion of energy we absolutely reverse these conditions and are enabled to operate at practically unlimited distances with extremely high efficiency and very low first cost.

The invention of the incandescent lamp marks the commencement of an era upon whose threshold we now stand and in which the possibilities of engineering will be extended to a degree we can, at present, have no adequate conception of. Until the Edison lamp was invented and introduced, all distribution of electrical energy was by what is known as the series system, which did not lend itself readily to the development and use of electric motors. With the Edison lamp came the system of distribution on the multiple arc plan and the commercial possibility and development of electric motors dates from that time.

The stationary electric motor, supplied from the lighting circuit, was naturally the first on account of the number and simplicity of its applications; then the motor was applied to propelling street cars, and the modern electrical street railway system was rapidly evolved. The electrical engineer, in his search for "new worlds to conquer," next turned his attention to the mining field.

The great variety of the applications in this field, the distance from the mines to the principal cities, where electrical developments have been most rapid, and the lack of knowledge as to the exact requirements have, until recently, made even the simplest applications of electricity to mining rather rare.

Perhaps the greatest stumbling block has been the percussion drill. Until recently, when a mine owner asked if we could transmit his power, light his mine, and operate his pumps, hoists, tramways and mills, we would confidently reply "Yes!" But when he asked if we could replace or operate his air drills, we were obliged to say, "Not yet."

Since the drill is the most universal of all mining appliances operated by power other than hand power, it was not possible to make rapid progress until this deficiency was corrected.

The Edison General Electric Company has put upon the market in commercial form, during the past thirty days, three types of electrical drills which will enable the mining engineer to accomplish all that he has been able to accomplish heretofore by other drills, and not only this, but to accomplish far more than was heretofore possible and under conditions heretofore prohibitory.

First in importance comes the Electric Percussion Drill, the invention of Mr. H. N. Marvin, of Syracuse.

Following is a brief description of the principal features of this drill :

Fastened upon a suitable tripod or column is a piece of boiler tube, seven inches in diameter and about two and a half feet long. In the forward half of this casing are placed two cylindrical coils of wire in the form of solenoids, each about 8½ inches long, having an outside diameter of about 6¾ inches, so as to make a loose fit with the casing, and an inside diameter of about 2⅛ inches. These two solenoids are placed so as to be against each other end to end in the casing. The bit plunger plays freely through the centre of these solenoids and is supported by two bearings placed just beyond the outside ends of the two solenoids respectively.

The back portion of the casing contains a spiral spring of the form frequently used for car springs. The plunger is composed of a central portion made of wrought iron about fourteen inches long, and both the forward and back portion of the plunger, which are made of aluminium bronze, are rigidly fastened to this iron portion. The forward portion is about 13 inches long and carries the bit socket. The back portion is spirally milled for a length of about 9 inches, so that the cross section of this portion is hexagonal. At the extreme back end is a steel buffer which strikes against the cushioning spring.

The spirally-milled portion of the plunger is similar to that used in other percussion drills, and causes the drill to revolve upon its axis ⅙ of a complete turn with each stroke. The ends of the coils of wire are brought to contact pieces at the top of the adjacent ends of the two solenoids, where there is a socket for receiving the terminals of the cable, and thus making electrical connection with the drill. There are three conductors leading from the generator to the drill, one of which is connected to one terminal of each of the solenoids, and the other two conductors are connected to the two remaining terminals of the solenoids respectively.

The generator is of the simplest kind, the coils on the armature having their terminals connected to two insulated collars on the shaft.

One collar is a continuous metallic ring, and upon this one rests a brush which is connected with the conductor, which is common to both solenoids. The other collar is metallic for half of the circle, and the remaining half is insulated from the armature wires. Upon this half ring rest two brushes diametrically opposite each other and each brush is connected to one of the two remaining conductors leading to the solenoids in the drill.

If now we revolve the armature of our generator in a separately excited magnetic field, an electric current will flow, let us say, from the armature to the half ring, then through one of the two brushes which happens at the instant to be in contact with the half ring, along the corresponding conductor to one terminal of one solenoid, let us suppose the rear one; then through the rear solenoid itself, and back along the mutual wire to the continuous ring and then to the armature again.

This current, in passing through the rear solenoid, makes a powerful magnet of it, and this tends to pull the plunger back into a position such that the centre of its iron portion shall be in the centre of the rear solenoid.

When the armature moves forward a half revolution the polarity of its wires is reversed, and the other brush, with its conductor, is now in contact with the half circle; consequently, the current in the mutual wire will be in the reverse direction from that of the former wave; the rear solenoid and its conductor, formerly active, are now out of circuit, and the circuit is made through the other conductor and its corresponding solenoid, that is, the forward solenoid.

The magnetic action of this solenoid tends to make the plunger move forward, so that the centre of the iron portion shall be in the centre of the forward solenoid.

Thus we get a reciprocating action of the plunger, and every revolution of the armature of the generator will cause a complete stroke of the drill. By varying the speed of revolution of the generator we can make the drill strike any number of blows per minute we choose. In usual practice 600 blows per minute are found to give excellent results. The spiral spring, it will be observed, stores up the energy of the back stroke and returns it to the forward stroke, assisting the magnetic impulse and greatly increasing the strength of the blow.

In order that we may form an unbiassed judgment of this drill, I will quote the opinion of André, perhaps the best authority on power drills, who, many years ago, stated the requirements of a first-class power drill to be as follows:—

1. Simple in construction, strong in every part.
2. Few parts, especially moving parts.
3. As light in weight as can be made strong.
4. Take up little space.
5. Striking part of relatively great weight, and strike directly.
6. Piston alone exposed to shocks.
7. Piston capable of variable length of stroke.
8. Sudden removal of resistance should not injure any part.
9. The rotary motion should be automatic.
10. The feed of machine, if automatic, should be regulated by the advance of the piston as the cutting advances.
11. Should be capable of working with moderate pressure.
12. Should be readily taken to pieces.

It may be sufficient to say that the Marvin drill possesses every one of the good qualities André specifies, and in a most marked degree; but, in describing the good qualities of this drill, we can, if necessary, add considerably more than André specifies. For example:—

1. It is simple in construction and strong in every part.
2. It has a minimum of moving parts, that is, one.
3. It is very light in weight, for its strength—this being possible because of the perfect cushioning at both ends of the stroke.
4. It takes up very little space.
5. The striking part is of relatively great weight, and strikes directly.
6. The length of stroke is variable at will.
7. The drill cannot damage itself by its own blow.
8. The rotary motion is automatic.
9. It has very few parts.
10. It can be entirely taken apart and put together again inside of ten minutes.
11. There are no joints to be fitted or packed.
12. It is not affected by heat or cold.
13. It can be operated at great distances from the source of power.
14. It has a much higher efficiency than other drills.
15. It is independent of the action of any valve.

16. The rate of striking is independent of the kind of material it strikes.

17. It will operate in the open air without striking anything, and hence can be made to strike an extremely light blow at its full rate, which is very important in starting holes, and so forth.

18. It can be rapidly moved from one position to another at a great distance, since the energy is transmitted through flexible cables.

19. No loss is suffered due to elbows, bends, valves, etc., in the conductors.

20. The conductors can be carried on very light supports, both because of their light weight and because the transmission of energy through them does not tend to distort their position.

The importance of the above characteristics will be apparent to any one who is familiar with the operation of the steam and air drills.

It is interesting to note that in driving the Hoosac Tunnel the average life of the power drills, before sending them to the shop, was fifty hours. Even to-day, after a development of twenty-five years, we find that it is a common practice to have in the shop one-half the total number of drills employed.

In pushing engineering work it is frequently of paramount importance that the work be done quickly. Therefore, any means of greatly increasing the rate of drilling is extremely valuable. To increase the rate of drilling we must either increase the strength of each blow or else we must increase the number of blows per minute. A limit to the rate of striking is soon reached when a valve of considerable weight must be moved from rest by the concussion of the previous blow, and when a material substance, such as air or steam, must then fill the space back of the piston and raise the pressure to the working pressure. Also the strains and shocks caused by the valve and the air or steam soon become troublesome as we increase the rate of striking. With the Electric Drill the speed of rotation of a perfectly balanced cylindrical armature of small diameter alone determines the rate of striking, and there is apparently no limit to the rate of striking, except the possible rate of the magnetizing and de-magnetizing of iron, which is already done in daily commercial practice at the rate of 10,000 times per minute with the highest efficiency.

With 800 blows per minute we have already drilled at the rate of four inches per minute a hole 1½ inches in diameter in the hardest Quincy granite, and that with an expenditure of energy not exceeding three horse power.

I firmly believe that in a comparatively short time we will be furnishing percussion drills whose rate of striking will be several times as much as that we now employ, and that with no more and no heavier drills than are now used, the rate of driving a heading will be increased many times. The importance of rapid driving of work is practically illustrated by the fact that in the Sutro tunnel, Mr. Sutro offered the men at work, in addition to their regular wages, the following bonus:—

For every foot per month over 300 and under 400	$ 5
" " " 400 " 500	10
" " " 500	20

A bulletin from the Census Department, under date of March, of this year, shows that in granite quarrying the cost of labour is 84% of the total cost of production, and in Massachusetts, where the output is much greater than in any other State, and where the longest experience and most approved methods are met with, the labor is 82½% of the total cost. It will be evident that any labor-saving device in such a field will be extremely valuable.

Another drill of great value to the mining engineer is the Diamond Drill. The Edison General Electric Company have, during the past thirty days, put upon the market an electric diamond drill which they have been developing for the past two years. The drill is the invention of J. E. Storey, of Denver. It presents a great many advantages over the diamond drills heretofore used, as will be evident from the following description of it:—

The drill weighs complete 239 pounds. The average power consumed is about 1¾ h. p., and with this expenditure of power the drill will bore a hole of 1¼ inches diameter in hard rock at the rate of two inches per minute, taking out a core of ¾ of an inch. The drill rod is rotated at the rate of 400 revolutions per minute without any load, and when drilling at full load the speed is practically the same.

The drill rod is geared by a single set of gears to an electric motor which revolves at 1,600 revolutions under conditions of full load. The motor has four poles, and the keeper joining the poles is in the shape of a surrounding cylindrical shell, which thoroughly protects all the parts of the motor and other parts of the machine.

Upon the drill rod is placed a rotary pump which supplies the drill with the necessary water.

In using the diamond drill the following points are of great importance :—

1. The speed should be uniform and automatically controlled very closely, so that removing the load quickly will not permit the drill to run away.

2. The drill should run at as high a rate of speed as is consistent with smooth drilling and a proper supply of water.

3. The drill should be extremely steady, as any material vibration transmitted by the drill rod to the diamond points is disastrous to them.

4. The drill should be as light and compact as is consistent with the requisite strength.

5. The drill should be capable of being readily and rapidly moved considerable distances and put into operation again with the least loss of time.

Up to the present time diamond drills are operated by reciprocating engines, and the engine is fastened upon the same frame as the drill rod, to which it is geared by suitable gearing. The engine usually has two cylinders of the oscillating type to reduce the vibration as much as possible, and eliminate the dead points. With these small engines it is practically impossible to automatically get the close regulation of speed which is desirable, and the speed is governed entirely by hand throttling. The engines cannot be run at very high speeds because of the vibration they would produce, and because of the rapid depreciation of such engines at high speeds. It, therefore, becomes necessary to gear to the drill rod, by gearing which is oftentimes objectionably large, and would become even more so if a higher speed upon the drill rod were attempted, as is desirable. The space occupied by the drilling machine is quite large, as the engine, gears, etc., occupy much space. This is a great objection in cases of operation in tunnels, shafts, etc.

With the electric drill the motion is free from any jar, as there are no reciprocating parts, and the speed can be made absolutely constant under any condition of load up to full load. The speed of the drill rod can be made anything desired up to several thousand revolutions per minute, if desired, and under any conditions of speed above 1,600 per minute there would be no gears whatever. The weight of the electric diamond drill is, for the same power, much less than that of the steam diamond drill, and the space occupied is in a direct line with the hole, and is extremely small in amount.

The drill can be operated from any existing electric light circuit, and the current for it can be supplied at two miles' distance from the source of power by wires of size No. 10 B. W. G., having a diameter of about $\frac{1}{8}$ of an inch. The drill can be carried wherever a man can carry 35 pounds, which is the weight of the heaviest single part, and hence can be quickly set up and operated in the most inaccessible places.

It will be evident that for prospecting work, when a certain territory is to be explored, this drill is particularly adapted.

Starting from a convenient and economical source of power, we can, if desirable, lay our wires along the surface of the ground, and in a very few hours can be operating our drill miles off. We can then reel up our wire and lay it again in an exactly opposite direction, and again be in operation at perhaps five or ten miles off in the course of a few hours more. In laying the wire, a couple of horses yoked abreast and carrying the reel, is all that is necessary. For operating at a distance of one mile in any direction, the diameter of the wire necessary is but $\frac{1}{16}$ of an inch, and the total weight of the wire only 340 lbs.

The facility with which prospecting, and also drilling in permanent works such as mines, can be done with this drill, will no doubt lead to its rapid and general use.

There is every reason to expect that with the electric diamond drill the speed of the rotation of the drill can be very greatly increased, with consequent increase in the rate of drilling, which is of the greatest importance.

The Edison General Electric Company have a third kind of drill, which is a rotary high speed drill, having a solid steel bit, and this drill is used for drilling coal and similar comparatively soft materials, and also for drilling metals, where it will have an extensive use in the construction of steel ships and bridges, and similar works where the drill has to be taken to the work rather than the reverse.

With the three drills which I have described, the Edison Company is now able to do any class of drilling desired, and these drills are likely to play an important part in the future of mining engineering.

The electric mine locomotive and the hoists, pumps, ventilating fans, crushers, stamps, etc., operated by electricity, are instances of the application of electricity to mining which have already proved themselves entirely successful. The undercutting of coal by electricity is an important field in which the Edison Company has made great strides, the machines being of two entirely distinct types, which becomes necessary in order to properly comply with the conditions met with in practice in different mines.

The electric refining of metals, especially of copper, is an extremely interesting subject to the mining engineer. The Edison Company have established the majority of the plants of this nature in the United States, and I need only say that the results are highly economical and most satisfactory in every way.

The electrical transmission and conversion of energy at great distances is destined to come up in nearly every mining problem in the future. Mines are usually in a mountainous country, and it is seldom that a water power cannot be found within a few miles of a mine. The mining engineer in the immediate future will, to develop this water power, convert its energy into electric energy, in which shape he will transmit it to the distant mine, when it will be again converted into the various forms of energy which he may have occasion to require.

Among the applications will be the following :—

1. The lighting of the mines and the buildings and grounds by arc and incandescent lamps.

2. The operation of any machinery in the mill, such as crushers, stamps, etc.

3. The operation of the drills.

4. The operation of the hoists.

5. The operation of the pumps.

6. The operation of an electric tramway in the mine.

7. The operation of ventilating fans.

8. The heating of the buildings when fuel is scarce.

9. The refining of copper and recovery of gold and silver in certain cases.

10. The concentration of magnetic ores in certain cases, such as iron, nickel, etc.

In order to give to you a commercial idea of a plant such as is likely to be used in mining operations in the immediate future, I will suppose a case and give you an estimate of the first cost and operating expenses of such a plant. Let us suppose that we have a mine where we have to operate the following devices:—

360 incandescent lamps of 16 candle power each.

10 arc lights.

1 hoist requiring 30 horse power.

1 pump requiring 20 horse power.

6 percussion drills for drilling 1½ inch holes at the rate of 3 inches per minute.

2 rotary diamond drills 1¼ inch hole, ¾ inch core, rate 2 inches per minute.

1 mine locomotive 10 horse power.

Milling machinery requiring 30 horse power.

Heating requiring 10 horse power.

The total power required for the above will be 180 horse power, delivered by the main motors. Suppose that at a distance of three miles there is a good water power which can be developed and equipped with water wheels to produce 300 horse power by an expenditure of $15,000. In considering transmission of the power by electricity, we must first determine what loss we shall sustain in transmission, and then we must determine what electrical pressure we will operate with.

In designing such a plant, there are certain fixed laws governing the conditions of highest economy and minimum first cost, and some years ago I investigated these questions and deduced formulæ expressing these laws.

It may be interesting to note here, in passing, a fact which you will observe by examining the formulæ given, namely: If we pay proper attention to the laws governing the highest efficiency and least first cost, the cost of the conductors for the plant will be independent of distance and will depend solely upon the percentage of loss we decide to sustain in the conductors. Thus, under practical conditions to-day, if we are to operate at 15% loss we should employ a pressure such that, at the distance in question, the cost of copper for each horse power delivered at the motor brushes would be $7.47. Similarly the cost of copper per h.p. corresponding to 20% loss would be $11.20 and that corresponding to 25% would be $16. This simple but invariable law, which is embodied in the formulæ given herewith, you will find of great assistance to you in considering questions of electrical transmission.

You will also notice that the formulæ show that the electrical pressure to be employed will vary directly with the distance. Thus, for 20% loss, the cost of copper being $11.20 per horse power delivered at motor brushes, the e.m.f. necessary for transmission of 16,000 ft. will be 1,500 volts; at 32,000 ft. we should use 3,000 volts, and at 8,000 ft. 750 volts.

Suppose that after investigating the question of the value of the original power we find that a loss of 25% in the conductors will make the value of the power wasted in the conductors per year just equal to the interest on the investment made necessary by the power wasted in the conductors. This loss will then be the most economical to operate at, according to Sir Wm. Thompson's well known law. Now, by reference to the curves on sheet No. 2, we find that to operate at a distance of three miles with 25% loss, the minimum of first cost will be realized when we operate with an initial electrical pressure of 1,200 volts.

In order to secure the 180 horse power necessary at our various devices in and about the mine, we must deliver 200 horse power to our main motor in the form of electric energy in the conductor at the brushes of the motor. With 25% loss in conductors this will mean 266 horse power at the generator brushes or 300 horse power delivered by the water wheels.

For the sake of reliability and economy, we will use two generators instead of one, each being of 133 horse power. At the mine there will be two main motors of 90 horse power each, wound for 900 volts and 83 amperes, producing a total of 180 horse power which will drive the drill generator of 17 horse power, and a generator of 250 volts and 300 amperes for operating the incandescent lamps, the arc lamps, the mine locomotive, the hoist, the pump, the diamond drills and the heating. The main motors will also supply the milling machinery with the necessary 30 horse power.

By formulæ on sheet No. 1, we find that to transmit 180 horse power three miles with 25% loss and an initial pressure of 1,200 volts there will be required a wire having a circular millage of 190,000 circular mils; this is having a diameter of 436 thousandths of an inch, or a little less than half an inch.

We find by other formulæ on sheet No. 1 that the copper will weigh 20,000 lbs. and will cost $4,000, which results check each other and prove the accuracy of the calculation.

We are now able to make an estimate for the total plant, as follows:

Estimate of Cost of Plant for Transmitting 180 h.p. a Distance of Three Miles, with a Loss of 25% in Conductors, the Plant to Comprise the Apparatus as Specified.

Developing original water power and installing water wheels of 300 h. p.	$15,000
2 Generators, 100 K.W. each (1200 v., 83 amp. each, @ $36 per K.W.	7,200
2 Motors, 75 K. W. each (900 v., 83 amp.), @ $36 per K. W.	5,400
Copper, 32,000 ft., No. 000, B.W.G.	4,000
1 Six-drill Generator	2,000
1 Generator of 250 v., 300 amp., 75 K.W., @ $36	2,700
6 Electric Percussion Drills	3,300
2 Electric Diamond Drills	1,100
360 Incandescent lamps and appliances	360
10 Arc Lamps	220
1 30 K. W. hoist	2,255
1 20 K. W. pump	1,595
1 10 K. W. locomotive	1,815
Heaters, 10 K. W.	600
Conductors for all secondary transmissions	1,000
Labor of Installation	3,000
Poles	455
Freight, cartage and sundry expenses	1,000
Total	$53,000

The operating expenses of such a plant will be those mainly due to the wages of two men for each shaft—one at the water power and one at the mine.

A fair allowance for depreciation and repairs will be 5% per annum of the first cost.

The operating expenses will therefore be about as follows :—

1 First Operator, per year	$ 900
1 Second Operator, per year	600
Depreciation and Repairs, 5% on $53,000	2,650
Sundry Incidental Expenses	250
	$4,400

The production of the same power by steam, when coal is $2 per ton, and labor such that an engineer's wages are $2 per day, would not be less than double this amount; and in many instances, where water and fuel, suitable for the generation of steam, are difficult to obtain, such a plant would represent a saving of its entire first cost every year.

RECENT DEVELOPMENTS IN ELECTRIC MINING APPARATUS.

By Mr. J. W. Kirkland, Boston.

No other section of this continent offers such exceptional and striking facilities for the introduction of electricity as does this great Province of Quebec. Nature has been bounteous in her distribution of water, and your hills have by their ruggedness forbidden these masses of water from pursuing a slow and unbroken course to the sea. In travelling through your country the visitor from the States is impressed with the fact that there is hardly a town, hardly a mine, hardly a factory, which is not almost within hailing distance of some river or torrent which has for ages been expending its kinetic energy in re-arranging its channel and cutting away the rock over which it flows. These waterfalls are destined to become the great agency for opening your mines and driving your mills and for transporting their joint products. So much for the water facilities; but we may still go further in congratulating you upon your possessions of cheap power. Even where water power is not at hand, you are still more advantageously situated than are your neighbors—with your great woodlands waiting to be cleared in order that better things may be planted, and in the clearing supplying cheap fuel for your boiler fires.

In connection with the development which is bound to spring from these great natural bequests, one fact is assured. One powerful agent, electricity, must play an important part. The strides in its application have been tremendous in the last few years; the prophet who will not foretell still greater ones to come is faint-hearted indeed.

An electric mining equipment consists of three elements, each to be considered separately and each forming a distinct part of the problem to be solved. They are: the generating plant, the line, and the motor or other device for utilizing the current. The generating plant, which comes first, from its very nature, differs but little from electric lighting installations, already so common, the dynamo electric machines having, however, rather a different form. The measuring and productive devices consist of the usual ground and potential indicators, the lightning arresters, the hand switch and the automatic cut-outs, the desirable position of which and the method of connection are often prescribed by underwriters' rules. The generators are, as a rule, wound for an electric potential of 220 volts, this seemingly odd quantity having become one of the standard units of electric pressure by reason of the fact that the incandescent lamp is conveniently made for a pressure of 110 volts, so that upon 220 volts two incandescent lamps may be run in series. The pressure chosen is one which is perfectly harmless to either human or animal life. It admits of very perfect insulation in the underground chambers of mines, which are, as a rule, impregnated with moisture which is always seeking to form a by-path for the electric current. The generating station requires primarily a source of power, whether of water or steam, and its position with reference to the mine is therefore determined principally by the condition of obtaining power cheaply and conveniently. It may be several miles from the mine or quarry, it may be in the quarry, or again it may be at the bottom of the mining shaft, as is the case in a somewhat celebrated plant in the Comstock Lode.

The line is so simple a feature as to require no description. You have your poles close at hand, generally needing but a few strokes of the woodsman's axe to prepare them for their work; your wire and supplies you can buy cheaply right here in Canada.

Having brought your power to the mine, the ways in which you can dispose of it are almost without limit; with it you may displace your ponderous steam pump, your costly air compressor, your steaming, sweating, and worse still, short-lived mules; and last, but not least, your dangerous miner's lamp. With it you can ventilate the most remote corner of your workings, and the shaft which has previously been useless because mother nature has chosen it as an artery for her watery blood becomes, by the introduction of an electric pump, a dividend-paying property.

But I will come to my real purpose in reading this paper to-night; that is, to bring before you some of the specific methods in which this invisible agent is to be made use of.

As we had the pleasure of listening to a very interesting talk by Mr. Leonard, on the subject of electric rock drills, it will not be necessary for us to deal very fully with that part of the subject, and I will confine myself to a few brief words, merely calling your attention to the form of drill invented by Mr. Chas. J. Van Depoele, and manufactured by the Thomson-Van Depoele Electric Mining Co. This photograph shows the drill as it appeared in a practical test made upon it at the quarry of the Cape Ann Granite Co., Cape Ann, Massachusetts, a few months ago. To bring this photograph nearer to each of the members we have had prepared these prints, with which I hope all by this time are provided. The rock drill which is represented in the photograph and in the prints, has a capacity to open a hole two inches in diameter in the hardest kind of granite that we are able to obtain for the test at the rate of something over 1½ inches per minute, and this with an expenditure of only about 2½ electrical horse power. The coils and connections, the carriers of the power-giving current, are completely enclosed within a solid iron casing and are simple in the extreme, a quality which should be one of the very first to be sought in designing all mining machinery, whether electrical or otherwise. A cable consisting of three separately insulated conductors of small cross-sections is connected to corresponding terminals in the junction box at the top of the machine, seen near the letter G in the print. This diagram which has been prepared from the patent granted to Mr. Van Depoele on his invention, shows the three wires running from the dynamo D, and the three coils or solenoids within the drill. The central coil is traversed by a current pulsating in intensity but constant in sign or direction, which serves to keep the iron core or piston in what is electrically termed a saturated condition—that is to say, a state of maximum magnetization at all parts of the stroke. It is termed a polarizer, and consists of many turns of small wire. One terminal of this coil is connected to one of the revolving brushes and the other to a stationary one which is in this case the negative. The current, therefore, in this coil varies from 0 to maximum and back again to 0, as the brush A moves from the position in line with the negative brush all round the commutator and back to its original place. Now examining the coincident conditions in the outside coils, first stating that these are wound of few turns of comparatively large wire, and so that if a north pole is at any instant at the inside end of the upper coil marked No. 1, a similar pole finds itself at the corresponding extremity of the coil No. 2.

Now the polarizing coil is energized by a current produced by the difference of potential between the brushes A and B equal to one half the voltage of the dynamo—or 110 volts. At this instant the outside coils are neutral because the brushes A and B are at their middle points, and the core is now drawn towards the middle of the drill, lagging behind the magnetism an appreciable amount.

Assuming now that a one-quarter turn of the yoke holding the revolving brushes has been made, the middle coil is now getting its maximum current due to the total electro-motive force of the dynamo; the outside coils are also at their maximum, and while one is tending to repel the similarly magnetized core in the direction of the other coil, the latter is itself at the same time exerting an attraction upon the core. Another one-quarter turn and the current in the outside coils has waned and disappeared entirely, and the current in the polarizer has also decreased to one-half its maximum value. Another one-quarter turn and the conditions are the same as those when the brush RC was in line with the positive terminal, except that the direction of current in the two outside solenoids is at present of opposite sign. The core is therefore pulled toward the other extremity of the drill. This action is repeated continuously, the magnetized core always seeking to place its north pole as close as possible to the nearest pole of opposite sign, that is, it tends to embrace at each instant the greatest possible number of lines of force, or in lay terms, magnetism.

From the above I hope that those of you who have not neglected your electrical education will see why the core is kept vibrating, making one stroke up and down for each complete revolution of the revolving brushes. The length of the stroke depends upon the rate of pulsation and upon the distance of the drill from the rock it is cutting.

This diagram, by the way, represents an electric generator in the usual conventional method which is probably familiar to some of you. The motion is imparted to the revolving brushes by means of a small intermediate shaft, belted to a sliding yoke which revolves close to the commutator and carries brush-holders at its two opposite extremities. It may be well to state that an automatic device consisting of a steep pitched screw and nut gives the drill a turn of 1/8 of a revolution at every stroke, thus insuring a clean-cut round hole. I leave you to judge of the compactness and solidity of the drill and its tripod from the prints. The same form is at present made in three sizes, of which the one represented is the largest. These drills are also, when required, placed upon quarry bars for mine and tunnel work.

Before leaving reciprocating apparatus entirely, it will be well to touch upon a machine similar in principle to the drill, viz., the reciprocating pump, in which the power end resembles in outward appearance the corresponding end of a steam pipe, but which, instead of containing a carefully turned cylinder with close-fitting piston and steam valves and joints, contains essentially the same arrangement of solenoids as I have described in connection with the rock drill. The pump is light and compact and lends itself readily to use in sinking shafts where space is of much importance, and where it is necessary to suspend the pump vertically and lower it by means of chains as the work progresses. A pump of this kind having a water cylinder of 4 x 8 inches, built by the Knowles Pump Co., Warren, Mass., is now on its way to Frankfort, Germany, for the great electrical exhibition to be held there during the coming summer. The results obtained from its tests may be of interest. I quote directly from the report of the expert in charge :—

KNOWLES' PUMP.*

Weight complete on base, about	800 lbs.
Weight of motor end	400 "
Strokes per minute	120
H. P. consumed, about	2½ or 3
Gallons raised per minute	50
Head	100 feet.

Passing now from electrical apparatus in which the magnetic attraction is exerted to produce rectilinear motion, let us turn to those in which the electric motor in its usual form delivers its energy by a rotary motion.

Mine traction is one of the first problems to be solved, and happily it is one to which electricity is peculiarly well adapted. This photograph and one of the prints which you have represents a new design of mining locomotive, capable of doing work at the rate of 60 h.p. This machine is being built for the Blossburg Coal Co., operating the Bear Run mine in Pennsylvania. Another of the same size is under construction for

* REMARKS—The water piston was so tight that it could not be moved by hand, so that a good deal of power was thus absorbed. After a day or two of continuous working this difficulty will be removed.

the Hillside Coal and Iron Co., another of 40 h.p. is to go to Schofield, Utah, and a fourth of 25 h.p. to the Livingstone Coal and Coke Co., Livingstone, Montana.

As will be seen, the mechanism is enclosed completely in an iron covering which prevents the admission of water and protects the moving parts from injury which might be caused by falling rock or careless workmen.

This machine weighs, complete, about 21,000 lbs.; it has an estimated traction of 2,000 lbs., at 10 miles per hour, and will haul a load of 85 tons at a speed of 10 miles per hour on a level. Its height over all is only 40 inches, and its gauge is 36 inches up. The 60 h.p. motor is carried directly upon the axle of the machine, and is reversible. Its speed and traction are under the immediate control of the driver or motorneer, as he is sometimes called, who is accommodated at one end of the platform with rheostat handle, reversing switch, and powerful brake within easy reach. No single pound of material is wasted in the construction of this machine; the great weight necessary to prevent slipping is usefully disposed of in the frame and platform, and in strengthening all parts. In this respect the new locomotive differs from other types in which the weight is too often supplied by attaching otherwise useless masses of iron to the platform.

The same form is preserved throughout all sizes. The method of conveying the current to the locomotive has been often described before and is probably known to a great many of you. Still for those who have not followed electric traction very closely it will, perhaps, be well to speak a few words upon this subject. At one side of the gangway, placed within a few inches of the roof, a bare hard drawn copper wire is supported by means of especially designed mining insulators, which are, in turn, fastened either to the timbers or, if the roof is good, directly to the latter. A trolley arm of rather ingenious design maintains a gun metal wheel in close contact with its bare wire and preserves an even upward pressure, accommodating itself to a considerable variation of the trolley wire.

The current entering the motor from the conductor enclosed in the trolley arm passes through the rheostat, the reversing switch, and the electric motor, and then passes from the wheels of the locomotive to the rails, which are bonded together by copper conductors through which it returns to the electric generator.

A complete line of frogs, switches, crosses, etc., are provided for the overhead wire which guides the trolley wheel in the proper direction.

It is not an unusual occurrence in mines to find steep grades of more or less length, which, if they were to be surmounted by the locomotive would require that it be of large capacity for hauling ordinary loads on level stretches; to do this work by such machines would therefore be uneconomical. How does electricity apply to these cases? I beg to call your attention to the third and last print—that of the electric hoist. By means of this machine a system of tail rope haulage upon the grades is operated, running from the top to the bottom, and doing the work of a locomotive in raising the cars. The hoist shown consists of a specially designed motor, waterproof in construction, mounted upon one bedplate with a hoisting drum, and geared to it through a friction clutch. This motor is like the one used in the mining locomotive, reversible, and its speed controlled by a rheostat. A strap friction brake is applied by the foot lever shown in the print. The clutch is operated by the hand lever, and the rheostat and reversing switch are manipulated by a third lever. The whole machine is compact and simple having few moving parts and requiring no skilled labor for its operation.

The following are some figures upon the 15 h.p. hoist:—

Total weight.................................... 4,435 lbs.
Speed of motor varying between 700 and 1,200 revolutions per minute.
Speed of winding drum varying between 24 and 41 revolutions per minute.
Efficiency from the energy in the wires to load lifted... 60%

When you consider that this figure of efficiency takes into consideration all the mechanical and electrical losses, such as friction of gears and of rope, you will, I think, admit that it is high.

I leave it to you, as practical men, to weigh the electric hoist against the steam hoist with all the small details of piping and valves which the name implies, and I feel certain that the latter will be found wanting.

The electric hoist is moreover a probable successor to the steam winch at the top of the mine shaft, used for raising cars and buckets.

These photographs show a form of electric pump which is quite worthy of mention. The mechanical part is made by the Goulds Mnfg. Co., and the electric motor is one of our standard type, especially prepared to be waterproof. An efficiency of about 70 per cent. is obtained from the complete and exhaustive tests made upon the various sizes of these machines.

Still another form of electric pump consists in the adaptation of a motor to a Knowles standard power pump, in which the motion of the armature shaft is transformed into a reciprocating motion by means of a set of worm gears and cranks.

We have now touched upon the most prominent features of an ordinary electric mining equipment with the exception of the electric lighting, which is a matter somewhat apart from our subject.

It only remains to be said that incandescent lamps can be placed wherever desired and made to receive their current from the same wires which supply the energy for the motor and devices.

In conclusion, gentlemen, I wish to say that the Thomson-Houston International Electric Co. stands ready to give further information on these subjects upon demand; and I extend to you all in its name, collectively and singly, an invitation to visit the Thomson-Houston factories in Lynn, Mass., whenever you may find yourself in that part of the country.

After a cordial vote of thanks had been passed to the gentlemen for their interesting papers, the members visited the Marvin electric percussion drill plant, which had been erected in the University grounds, and witnessed its operation under direction of Mr. W. M. Schlesinger, the expert of the Edison Company, New York. The experiments, although conducted under much difficulty, sufficiently demonstrated the utility of the drill as an important factor in mining and quarry work. The drill was then taken to pieces, and the simplicity of its parts pointed out. The members were well pleased with the demonstration, and many favorable opinions were passed as to its application in the immediate future.

First Annual Dinner.

In the evening the first annual dinner of the Association was held in the Ladies' Ordinary of the Windsor Hotel, Montreal. About seventy members and guests were present. Hon. George Irvine, Q. C., President of the Association, occupied the chair, having on his right Sir William Dawson, Principal of McGill University, and on his left Mr. R. Archer, President of the Montreal Board of Trade. The vice-chairs were presided over by Mr. S. P. Franchot, managing director of the Emerald Phosphate Company, Buckingham, and Mr. D. A. Brown, Bell's Asbestos Company, Boston. After an excellent dinner the Secretary intimated letters of apology from the following: Sir Donald Smith, M.P., R. Prefontaine, Q.C., M.P., W. B. Ives, M.P., R. N. Hall, Q.C., Frank Grundy, Manager Quebec Central Railroad, Prof. T. Sterry Hunt, New York, Rev. Abbé Laflamme, Quebec, Hon. F. Langelier, M. P., Quebec, Hon. G. A. Drummond, Montreal, Dr. G. M. Dawson and Dr. R. W. Ells, Ottawa, Mr. J. M. Reid, President Gold Miners' Association of Nova Scotia, T. R. Gue, Halifax, John E. Hardman, S. B., Oldham, A. Blue, Toronto, and others.

"The Queen" having been loyally honored, the chairman proposed "Our Province," and called upon Mr. R. Archer, President of the Montreal Board of Trade, to respond.

Mr. Archer thanked the Association for extending to him an invitation to be present. After dwelling on the mineral resources of the Province, and the importance to the country and to the Province of the continued extension of their development, he referred to the Mining Act passed by theQuebec Legislature, and stated that the Board of Trade of Montreal had made every endeavor to frustrate it. He expressed his pleasure in meeting the members of the Association around the festive board, and stated that he would urge the Council of the Board of Trade to assist in giving that protection to mining men which they certainly deserved.

Mr. Ernest C. Arnoldi sang in fine style, "Drill, ye Tarriers, Drill," which was quite an appropriate song, and was well received.

Mr. W. Hamilton Merritt, M.E., Toronto, proposed "The Mining Industries of the Province of Quebec." He said: "I am very glad to have the honor of proposing this toast because, as an Ontario man, I feel it a pleasure to be amongst the Quebec mining fraternity, and accepting from them their kind hospitality. I am delighted to have the opportunity of meeting personally the mining men of the Province, for I think if there is any branch of industry the world over, where there is good fellowship and a sort of freemasonry, it is to be found among the mining fraternity. The mining industries in the Province of Quebec are indeed well worth the utmost enthusiasm on the part of Canadians, for in no province has there been such advancement in recent years as in your Province of Quebec. Your asbestos is known the world over, where its manufactures are used; your phosphate has established for itself a celebrity none the less wide, and of course the copper industry in Quebec has been proved to have a permanency about which there is no question whatever. The mining industry is so precarious, and capital so shy, that encouragement and not restriction, or vexatious regulations, should be the policy of every government; therefore, to-day, I was surprised in hearing, in the discussion on the Quebec Mining Act, that if a man goes off into the comparative wilds and obtains a mining location, it is necessary for him to pay a license of $150 for the erection of a powder magazine. If this is the case I am sure there would be every justification for what might be termed a very decided "kick" all over the Province against it. I feel that all mining men are proud of the advancement that has been made in mining affairs in Quebec and in Canada generally; but when we realize our position in comparison to that of our neighbors to the south of us, where nearly six hundred million dollars are produced annually, while we produce less than twenty million dollars, I think it will be apparent to all that every assistance should be given us by the Government in bringing the industry to that condition which our mineral resources warrant. We cannot, and do not, expect the Government to do prospecting and mining, but I believe that we have a right to request the acquisition and preservation of facts relating to mining and metallurgy, and the creation of an official and authentic reference literature relating thereto. Sir William Dawson touched the very root of what is claimed to be a serious weakness in the present system of the Geological Survey, when he said 'that if the excellent publications of that body were carefully searched through much valuable information relating to mining development can be found.' Now it is contended with reason that while a Geological Survey is necessary, systematic attention and judicious assistance to the mineral and metallurgical interests is an equal, if not a greater, necessity; and if it can be accomplished in no other way, the former could be well curtailed to carry out the latter. While Sir William Dawson's able son was in charge of the Survey, we were able to induce the government to establish the Statistical Branch of the Geological Survey. This was a great step, and now we ask that mining and metallurgical information shall be condensed and not merely available in the form Sir William Dawson has indicated. The publications of the United States Geological Survey, edited by Dr. David T. Day, is more what mining men desire.

Mr. S. P. Franchot, in reply, referred to the taxation which the Quebec Government had recently imposed upon powder magazines, saying that taxation came as sure as death, but that he had not heard of royalties in this connection before. Mr. D. A. Brown also responded and spoke very encouragingly of the asbestos industry in the Eastern Townships.

Mr. Franchot proposed "Our Science School and Professors," remarking that he felt grateful to the schools, and hoped that a kindly feeling between them and mining men would always exist.

Sir William Dawson replied. He referred to the fact that his interests in mining matters were more of an educational nature than a pecuniary one, and said that a very great deal of what was known as regards the structure of the earth to-day was due to the mining engineer and mine explorer, and geologists were extremely thankful to them for the information. Speaking of the School of Science recently established at the University of McGill, he said that they looked to the members of the Association as educators of the young men who graduated therefrom. "Your meeting here to-day," he said, "will do more to assist you in asserting your rights, on account of the investigations carried on, than any direct agitation."

A humorous song by Mr. W. H. Irwin, was followed by Mr. B. T. A. Bell presenting the toast "Kindred Associations," Prof. H. T. Bovey, representing the Canadian Society of Civil Engineers, responded briefly, as did also Mr. W. Hamilton Merritt, representing the Canadian Institute of Toronto.

The last toast, "Our Guests," was responded to by Mr. H. Ward Leonard in a very happy manner. An enjoyable evening was brought to a close at midnight by the company joining hands and singing "Auld Lang Syne" and the National Anthem.

QUEBEC MINING ACT.

Interview with the Deputy Minister of Justice.

Ottawa, 17th July, 1891.

The Petition prepared by the General Mining Association of the Province of Quebec, having been presented to the Privy Council, and a hearing being granted by the Hon. Sir John Thompson, Minister of Justice, the following deputation attended at Ottawa on the morning of Friday, the 17th July: A. Desjardins, M.P., Montreal; W. B. Ives, Q.C., M.P., Sherbrooke; Hon. G. Irvine, Q.C., Quebec, President of the Association; C. Magee, Managing Director Bristol Iron Co., Ottawa; J. Lainson-Wills, Manager General Phosphate Corporation; Capt. Robt. C. Adams, Managing Director Anglo-Canadian Phosphate Co., Montreal: Hector McRae, Ottawa, and B. T. A. Bell, Secretary General Mining Association. The members were received by Mr. Robt. Sedgewick, Q.C., Deputy of the Minister of Justice, at half past ten o'clock.

Hon. Geo. Irvine, Q.C., said: There are three grounds upon which we seek to have this Act disallowed. 1st. We claim that it is an unreasonable law because it deprives people of their vested rights in property for which they hold a title from the Crown itself. 2nd. That it is contrary to the general interests of the Dominion and to the policy of the Dominion Government. I presume that that would be a principle governing the disallowance of the Act, because it would produce chaos if the provinces were allowed to adopt Acts which nullify the policy of the Dominion Parliament and Government. 3rd. Because it tends to so impede, and in many cases to put a stop to the exercise of an industry which is of great importance to the whole Dominion. Now with reference to the claim that it takes away private property, that is most easy to understand and the simplest. In 1880, an Act was passed regulating Crown Lands generally, and having a particular reference to mining. Prior to the passing of that Act, it had been universally admitted and judicially decided, and the whole course of the jurisprudence of the country, as well as the management of the Crown Lands Department, and the regulations made by them, went to establish that where lands were granted without a reserve of minerals, all the baser metals—except gold and silver—became the property of the lessee. There is no doubt about that. Mr. Irvine here cited several important legal decisions in support of his contention.

MR. SEDGEWICK—If a seignior owns land in the Province of Quebec he may convey his interest and reserve the mines.

HON. MR. IRVINE—No; they cannot do that.

MR. SEDGEWICK—Well they can do it here and in all the other provinces.

HON. MR. IRVINE—You have no seignorial tenants in the other provinces.

MR. SEDGEWICK—But if you own a piece of property in the Province of Quebec, can you not reserve for yourself—an easement we would call it—for the purpose of having something off it?

HON. MR. IRVINE—The holding of the seigniory under the Feudal Rights is different from the holding of lands under the Crown. The former were made with a view to settling the country, copying the old style which still exists in France, and they were bound, whenever an application was made by a settler to make a grant to him, subject to an annual rent. One of the questions put by the Crown to the Court in one of the cases I have referred to was, whether, if a seignior reserves the baser metals in making a grant, would that reserve be legal. The Court held that it would not; that the property of the baser metals would go to the tenant censataire.

MR. SEDGEWICK—That was in consequence of the original grant under the Feudal law to the seignior.

HON. MR. IRVINE—I refer to that for the purpose of showing that a long time back the jurisprudence of the country held that the property in the baser metals, where they were not reserved, went to the owner of the soil.

MR. SEDGEWICK—I suppose you are giving that particularly because the Act alleges that all the mines in the province belong to the Crown. Is there any authority with respect to that argument in the Act?

HON. MR. IRVINE—Not in the slightest. In the case of the Queen v. DeLery, the question was the ownership of gold. In the original grant to DeLery there was no reservation of the precious metal, and it was argued that gold was included in the grant to the seigniory and that it followed that it went to the censitaires when the land was conceded to them. Later on the DeLery family, who were the seigniors of that property, made application to the Crown for a grant of the gold, and letters patent were made out and they have held possession of the gold deposits ever since, under that title.

MR. SEDGEWICK—Was this in Lower Canada?

HON. MR. IRVINE—Yes, in the district of Beauce. There is gold there, they are working at it now, and at one time there was a fairly large development. In that case (the DeLery) it was held that the ownership of the gold did not pass to the seignoir, therefore it did not pass to the censitaire.

MR. SEDGEWICK—But the Court of Appeals held that that did not apply to the baser metals that belong to the land. I do not think there can be any doubt but that everything does pass, unless expressly reserved.

HON. MR. IRVINE—The Act of 1880, provided: "That all grants which were made subsequent to the passing of the Act shall not be necessary to make a reserve of minerals when they were held to be reserved, that being so stated." Well, that of course was perfectly legitimate legislation, because it did not affect any vested rights, and anybody taking a grant took it subject to that legislation. But there was an important provision in that Act, *i.e.*, that if a man took a grant from the Crown under ordinary circumstances, that is for agricultural purposes, in which, under the Act, the mines shall be reserved—if such a person afterwards discovered minerals on the lot, he would have the right to obtain title to them by paying the difference between the agricultural price and the mineral price.

MR. SEDGEWICK—Did the province fix the price?

HON. MR. IRVINE—It fixed the price of the mineral lands, but the agricultural price varies. So that you understand everyone who obtained a grant of land previously was owner of the minerals under the general principle, but that everyone who obtained land after 1880 were not owners; but they had the right to purchase at the price fixed by the province. They would have the right when they discovered minerals upon it, to purchase the land by paying the taxed price. This was done in a property in which I am interested. This old Act was not objectionable for it interfered with no vested rights which came into existence after 1880. You will see, therefore that there are several classes of persons to be considered. Those who hold land under old grants; the holders of lands under old titles, in which titles the lands have not been reserved to the Crown——

MR. SEDGEWICK—I would like you to give me some evidence. You might, for instance, give evidence that you hold some lands under titles in which there is no reservation of that kind.

HON. MR. IRVINE—I can cite you a case of one of the best asbestos mines in the Townships, where the owners hold, and their predecessors held, their lands since 1802. The original grant was made in 1802, and descended by a regular chain of titles from the King family. They owned it for some twenty years before minerals were discovered, and they are now in the condition of persons holding land under a title direct from the Crown, in which the minerals were not reserved.

MR. MAGEE—I could cite another case where there is a very serious complication arising out of the operation of this new Act. Parties owning patented lands leased them to mining men at a certain rental per annum. These parties continued work for a number of years and the lands again pass into the third and fourth hands. I represent the Bristol Iron Co., and we are really the fourth purchasers—that is, we took an assignment of the original lease of the mining rights (a 99 year's lease), paying a rental. We erected machinery and plant and have considerably developed these mines, investing quite $150,000. We then got an opportunity of leasing, not only giving an assignment to all our rights in the mines, but of leasing our plant and machinery for a royalty of so much per ton, so that these last people have really to pay three rents, that is, if the new Act is held to be constitutional.

HON. MR. IRVINE—That has reference to the tax.

MR. MAGEE—They pay a tax to the owner of the soil, the royalty to the owner of the mining rights, machinery and plant, and then they have to pay three per cent. under this new Act, to the Government, on the merchantable value of the quantity raised, before they can export their ores.

HON. MR. IRVINE—I should say that, although there is no difference otherwise, there is an exception in the case of phosphate lands, principally as regards the date from which the law of 1880 takes effect. There has been a change made with regard to these lands in 1878, so that as regards phosphates, 1878 is the date referred to instead of 1880, as in the case of other minerals. In the interpretation clauses of this Act the definition of public and private lands is described as follows :—

"The words 'public lands' mean and designate all Crown lands or Ordnance lands transferred to the Province, etc., which have not been alienated by the Crown."

"The words 'private lands' designate all lands conceded or otherwise alienated by the Crown, other than mining concessions or lands conceded by the Crown as such, or which shall hereafter be conceded."

So that when private lands are used, it does not in any way affect lands granted as mining lands. Now clause 1425 says :—

"As it is admitted that mines, whether upon public or private lands, belong to the Crown, and any person discovering a mine may purchase the same, by complying with the provisions of this law."

Now private lands mean all lands which are not conceded as mining lands, that is to say, an ordinary grant for agricultural purposes is called "private lands," and the Government now declare that all these lands belong to the Crown.

MR. SEDGEWICK—Of course you have to give that a limited meaning. That may mean all mines upon public or private lands belong to the Crown where the Crown has not already parted with the title.

HON. MR. IRVINE—They define "private lands" to mean all lands which are not granted with mining privileges. Then this clause goes on following up this provision. "Upon private lands, however, the occupant of the surface has the first right to purchase such mine, upon the conditions imposed by law and the regulations." Before coming to that, however, the next clause provides :—

"From the first day of May, 1891, a royalty shall be levied in favor of the Crown, upon every mine which is now, or may hereafter be sold, conceded or otherwise alienated. Such royalty shall, unless otherwise determined by letters-patent already granted, consist of a percentage of three per cent. of the merchantable value of the products of all mines and minerals."

Now the meaning of that is that on all minerals taken from the Province of Quebec, there is a royalty of three per cent., whether the lands were sold as mining lands or otherwise.

MR. SEDGEWICK—Now, wherein do you say that this is unjust—any more unjust than a tax—say an income tax?

HON. MR. IRVINE—An income tax would not be a particular industry.

MR. SEDGEWICK—In what respect is it different from a license?

HON. MR. IRVINE—It is greatly different. You have to pay license fees besides this.

MR. SEDGEWICK—I mean a license to carry on a business or profession. It is a general tax upon a particular industry, it is true, but does it differ in any moral sense from any particular tax which a province may impose, for instance, they say an insurance company shall pay a certain tax?

HON. MR. IRVINE—The Privy Council decided that these commercial taxes were constitutional. Therefore, the question as to the legality of the law relating to one particular industry in face of that decision has been settled.

MR. SEDGEWICK—I agree with you that we ought to look askance at an Act which professes to interfere with vested rights—to take one's property without compensation and give it to the State.

HON. MR. IRVINE—I only mention this fact now—that they use the word "royalty," implying on the part of the person, the Crown or individual, who levies that right by statute, or otherwise, ownership in the property from which royalty is paid.

MR. SEDGEWICK—It does not make any difference what they call it. You say the Act infringes upon private rights in some other way.

HON. MR. IRVINE—I say I have a right to assume that all rights upon private lands conceded previous to 1880, belong to the grantee, and that all granted since 1880, belong to the grantee, subjected to the payment of certain sums of money. I will show you how the carrying out of this Act infringes upon private rights. You will observe it says that the Crown may sell mines on private lands, subject to certain regulations. Section 1455 says: "Every person, firm, or company may explore and prospect for the discovery of mines and minerals upon public lands not already occupied as mining concessions or otherwise."

And section 1461 says: "Any person may obtain from the Commissioner the sale of one or more mining concessions upon the following conditions:—

1. Upon private lands, after the owners thereof have been placed *in mora* to take a sale thereof, if they refuse to avail themselves of such rights; the whole in conformity with this law."

MR. SEDGEWICK—Do you not think a limited construction must be given to that, and apply it only to those lands which contain a reservation of minerals?

HON. MR. IRVINE—Take the lands since 1880, they have been by law reserved and subject to the right to purchase them.

MR. SEDGEWICK—Then may not that section only apply to those lands?

HON. MR. IRVINE—If that would be the construction the courts would give it; but I think it very doubtful. Now you see the effect of that legislation is that any person may go to the Crown and obtain a permit for exploration of private lands. He has the right to go on private lands and examine the lot, and he may take 50 acres of this lot, measure it out, go to the Commissioner of the Crown Lands and deposit the price which he considers this property is worth. There is a minimum price fixed by the Act, but no maximum price. He must deposit at least $5 per acre. We will take a man who has held a mining property for years. He believes by law that it belongs to him. Another man may go and obtain a permit from the Crown, go on to his property and measure out 50 acres, he offers $100,000, which this man must take or lose his property. That is a most outrageous invasion of private rights. The next point I spoke of is whether this tax (assuming it to be a tax), is of such a nature as to be unreasonable and against the public policy of the Dominion. As regards some mines it may be said that it is not, although a very heavy tax, but of course as to its being reasonable or unreasonable, that is within the right of the legislature that has power to pass the law to say.

MR. SEDGEWICK—Is the 3 per cent. royalty on the gross value of the output at the pit's mouth?

HON. MR. IRVINE—Yes. If you get a large quantity of minerals and for one reason or another you cannot sell them, you have got to pay this 3 per cent. not only on the minerals themselves, but on the cost of producing them.

MR. SEDGEWICK—Who determines the value?

HON. MR. IRVINE—They have inspectors who tax the value.

MR. SEDGEWICK—Have they principle upon which to fix the value?

HON. MR. IRVINE—No; there is no principle. There is no doubt that this tax weighs very heavily upon a large number of the mining industries of the country, and more particularly with regard to those industries where the marginal profit is very small, and the quantity produced very large and a great number of men employed. Of course the fact of a number of men employed is included in the small margin of profits. Supposing a man is working a mine and he with difficulty makes a very small profit. If you bring in a tax of 3 per cent. on the gross output of that mine, you may walk off with all his profits and make the Government pay something out of his capital. Now, the effect of this will be to put a stop to a large number of mining industries in which the Dominion has a very important interest. It is in the interest of the whole country that these industrial enterprises should succeed, and if the Provincial Government kills them by putting on a tax, it appears to me that the Act is one which the Dominion Government ought to disallow.

MR. SEDGEWICK—If it was perfectly clear that the object of this Provincial Act was to kill a particular industry, the Government would perhaps have good grounds to do so. We could not disallow an Act because it affects a particular industry unless clearly shown that the intention of the Act was bad and was aimed at the policy of the Government as a whole. For instance, the Legislature of Quebec has taxed the banking business very seriously, so as to prejudicially affect the banking interests, but we could not disallow that Act.

HON. MR. IRVINE—They put a heavy tax upon banks, but they did not put anything to seriously affect banking commerce.

MR. SEDGEWICK—They have compelled insurance companies to take out licenses in every town in which established. However, it seems to me that the imposition of a 3 per cent tax would not be sufficient of itself to justify the disallowance of the Act.

HON. MR. IRVINE—But suppose it were shown that in certain branches of the mining industry the effect of this would be to stop them altogether?

MR. SEDGEWICK—Well, I think that is a matter for the province to look after. While the Dominion Government has a general interest in the whole of the trade and industries of the country, I do not think it can interfere here.

HON. MR. IRVINE—At the last session of the Dominion Parliament all machinery imported for mining purposes was put on the free list—all not manufactured in Canada. Well, now, that of course was of great assistance, but if the Province of Quebec comes in and takes off the benefit of that by levying a tax, they are certainly defeating the object which the Dominion Government tried to attain by taking off that import tax.

MR. SEDGEWICK—They may do the same thing by coming into the market and borrowing a lot of money. The point is, where shall we draw the line?

HON. MR. IRVINE—I think that the Government is bound to disallow the Act for the first reason given—the interference with private rights.

After some further talk on the part of Messrs. Magee, Capt. Adams and Mr. McRae, the deputation thanked the Deputy for his courteous hearing and withdrew.

EXTRAORDINARY GENERAL MEETING.

MONTREAL.

WEDNESDAY, 5TH AUGUST, 1891.

An Extraordinary General Meeting of the Association, was held in the offices of the Treasurer, Mr. A. W. Stevenson, C.A., 17 St. John street, Montreal, on Wednesday, 5th August.

Present: Wm. White, Q.C., Eustis Mining Co., Sherbrooke; Col. Lucke, Beaver Asbestos Co., Sherbrooke; S. L. Spafford, Nichols Chemical Co., Capelton; D. A. Brown, Boston, and Capt. Sheridan, Thetford, representing Bell's Asbestos Co.; J. Lainson Wills, General Phosphate Corporation, Ottawa; S. P. Franchot, Emerald Mining Co., Buckingham; W. T. Gibbs, Dominion Phosphate Co. of London, Buckingham; Capt. T. M. Williams, Bristol Iron Co., Billerica, Que.; W. H. Jeffrey, Richmond, Que.; W. H. Irwin and R. T. Hopper, Anglo-Canadian Asbestos Co., Montreal; Wm. Sclater, Montreal; O. M. Harris, Canadian Phosphate Co., Montreal; Dr. C. Killing, DeNederlandsche Phosphaat-Maatschappij, Montreal; F. H. Green, Phosphate of Lime Co., Montreal; A. Lomer, Lomer, Rohr & Co., Montreal; Theo. Doucet, N.P., Montreal; Geo. Stewart, General Phosphate Corporation, Buckingham, and others.

In the absence of the President, Mr. S. P. Franchot was called to the Chair.

MR. A. W. STEVENSON read the notice convening the meeting, and explained that it had been called for the purpose of considering the circular letters issued by the Inspector of Mines, demanding returns of output and other statistics of the working mines of the Province.

After a long discussion in which Messrs. Green, Stevenson, Irwin, Franchot, White, Brown, Jeffrey, Harris, and others took part, the following resolutions were adopted:—

Moved by Mr. W. H. Irwin, seconded by Mr. W. H. Jeffrey:

"That inasmuch as a petition has been presented to the Governor-General-in-Council, praying for the disallowance of the Quebec Mining Act, passed at last Session, it is deemed advisable and hereby resolved, that pending a decision upon the said petition, the members of this Association be, and are hereby requested to refrain from completing and returning to the Crown Lands Department of the Province of Quebec, the affidavit and quarterly report recently issued by said Department, and that a copy of this resolution be forwarded to each member of the Association."

Moved by Mr. A. W. Stevenson, seconded by Mr. O. M. Harris:—

"That all matters arising out of the enforcement of the mining tax or royalty referred to in the preceding resolution be left in the hands of the Council of the Association."

The meeting then adjourned.

COUNCIL MEETING.

MONTREAL.

WEDNESDAY, 9TH DECEMBER, 1891.

A meeting of the Council of the Association was held in the offices of the Treasurer, Mr. A. W. Stevenson, 17 St. John Street, Montreal, on Wednesday, 9th December, 1891.

Present: Hon. Geo. Irvine, Q.C., A. W. Stevenson, Capt. R. C. Adams, L. A. Klein, S. P. Franchot, R. T. Hopper, J. Burley Smith, and B. T. A. Bell.

HON. GEORGE IRVINE, President, in the chair.

On the suggestion of the Chairman, it was agreed to recommend the appointment of a standing Law Committee, to deal with all questions of legislation affecting the welfare of the industry during the ensuing year.

It was also agreed to recommend to the Association that the Council be authorized to prepare and publish a volume of the TRANSACTIONS of the Association, containing reports of all meetings, papers read, work of deputations and other business incidental to the Association's operations.

The following business was transacted:—

Resolved: That the Second Annual General Meeting stand adjourned from Friday, 25th December, 1891, to Wednesday, 13th January, 1892.

Resolved: That at the Annual General Meeting a motion be submitted asking that the Constitution be amended to read: "The Annual General Meeting for the election of office-bearers, the transaction of the business of the Association and the reading and discussion of papers shall be held in the City of Montreal, on the second Wednesday in January of each year, instead of the last Friday of each year."

Resolved: That the Secretary and Treasurer be a Committee to arrange for the Second Annual Dinner of the Association.

Resolved: That the Secretary send invitations to the following guests: Sir William Dawson, Dr. Robert W. Ells, Dr. B. J. Harrington, Mr. J. T. Donald, M.A., Mr. James McShane, Mayor of Montreal, Hon. Honore Mercier, J. Obalski, M.E., A. Blue, Director of Mines, E. D. Ingall, M.E.

Resolved: That the Council recommend a grant from the funds of the Association to the Asbestos Club, Black Lake, and that the amount be determined by the members in Annual General Meeting assembled.

THE SECRETARY reported that the Hon. the Minister of Justice was in communication with the Hon. the Attorney-General at Quebec, with reference to the Petition of the Association anent the Quebec Mining Act, and that a final decision would probably be arrived at before the Annual General Meeting.

He also announced having arranged for the following papers to be read at the Annual General Meeting :—

(*a*) "Technical Education in its Relation to Mining."—By Sir Wm. Dawson and Prof. W. C. Carlyle.

(*b*) "Platinum : Its Mode of Occurrence and Uses."—By J. T. Donald, M.A., Montreal.

(*c*) "Mining Luck."—By Capt. Robert C. Adams, Montreal.

(*d*) "The Value of Geological Knowledge to the Mining Prospector and Engineer."—By Dr. Robert W. Ells, Ottawa.

(*e*) "Assaying by Electrolytic Methods."—By Prof. B. J. Harrington, Montreal.

(*f*) "The Collection of Mining Information and Statistics by the State."—By E. D. Ingall, M.E., Ottawa.

The meeting then adjourned.

SECOND ANNUAL GENERAL MEETING.

MONTREAL.

WEDNESDAY, 13TH JANUARY, 1892.

The Second Annual General Meeting, of the Association was held in the New Club room, Windsor Hotel, Montreal, on Wednesday, 13th January, commencing at eleven in the forenoon. There was a large attendance. Among those present were:

L. A. Klein, American Asbestos Company, Black Lake; F. Cirkel, Templeton, Asbestos Co., Templeton; D. A. Brown, Bell's Asbestos Co., Boston; S. P. Franchot, Buckingham; Col. Lucke, Beaver Asbestos Co., Sherbrooke; O. M. Harris, Canadian Phosphate Co., Montreal; John J. Penhale, United Asbestos Co., Black Lake; A. S. Johnson, Johnson's Asbestos Co., Thetford; Hector McRae, Electric Mining Co., Ottawa; George R. Smith, Macgregor Lake Phosphate Co., Montreal; F. Hilton-Green, Phosphate of Lime Co., Montreal; R. T. Hopper, Anglo-Canadian Asbestos Co.; Dr. R. W. Ells, and E. D. Ingall, Geological Survey of Canada, Ottawa; Prof. B. J. Harrington, Prof. W. C. Carlyle and Sir William Dawson, McGill University; H. A. Budden, Intercolonial Coal Co., Montreal; H. S. Poole, F.G.S., Acadia Coal Co., Stellarton, N.S.; J. T. Donald, M.A., Wm. Sclater and Theo. Doucet, N.P., Montreal; W. A. Allan, Little Rapids Mine, Ottawa; W. T. Gibbs, Buckingham; Capt. R. C. Adams, Anglo-Canadian Phosphate Co., Montreal; A. W. Stevenson, Montreal; and B. T. A. Bell, Ottawa.

HON. GEORGE IRVINE, President of the Association, in the chair.

THE SECRETARY having read the minutes of previous meetings, the following resolutions were adopted:—

(1) Moved by Mr. John Penhale, seconded by Mr. D. A. Brown, that the Council be authorized to publish for distribution among the members a volume of the TRANSACTIONS of the Association during the year 1891

(2) Mr. D. A. Brown, moved, seconded by Col. Lucke, that the President, with Mr. R. Prefontaine, Q.C., M.P., and Mr. Wm. White, Q.C., Sherbrooke, be a standing committee during the coming year to deal with all questions of legislation affecting the welfare of the mining industries of the province.

(3) Moved by Mr. S. P. Franchot, seconded by Mr. Wm. Sclater, that a sum of fifty dollars be donated by the Association to the Asbestos Club.

THE SECRETARY then read the following correspondence with reference to the petition to disallow

THE QUEBEC MINING ACT.

DEPARTMENT DU PROCUREUR GENERAL,
QUEBEC, 11th July, 1891.

The Honourable
The Minister of Justice,
Ottawa, Ont.

SIR,—I am directed by the Honourable the Attorney-General to acknowledge the receipt of your letter of the 8th July inst., enclosing for his information copy of a petition addressed to His Excellency the Governor-General, having reference to an Act passed by the Legislature at its last session, entitled "An Act to Amend and Consolidate the Mining Law," and in which you state that you would be glad to give all possible consideration to any observations which the Attorney-General may think proper to make respecting the said petition.

In answer the Attorney-General requests you to kindly grant him a delay until the 31st instant, within which to fyle an answer to the said petition, as the matter is an important one, and he will unavoidably be absent until the 18th inst.

I have the honour to be, Sir,
Your obedient servant,
(Signed), L. J. CANNON,
Assistant Attorney-General.

DEPARTMENT DU PROCUREUR GENERAL,
QUEBEC, 12th August, 1891.

To the Honourable
The Minister of Justice,
Ottawa, Ont.

SIR,—I am directed by the Honourable the Attorney-General, to send you for your consideration a memorandum having reference to a petition addressed to His Excellency the Governor-General relating to an Act passed by the Legislature of Quebec, entitled "An Act to Amend and Consolidate the Mining Law."

I have the honour to be, Sir,
Your obedient servant,
(Signed), CHARLES LANCTOT,
Law Officer,

DEPARTMENT DU PROCUREUR GENERAL,

QUEBEC.

To His Excellency the Right Honourable Sir Frederick Arthur Stanley, Baron Stanley of Preston, Etc., Etc., Etc., Governor General of the Dominion of Canada, in Council, Ottawa:

The Attorney General of the Province of Quebec, in answer to the petition of A. Morrison and others, proprietors of mining lands, and persons interested in mines in the Province of Quebec, praying that Your Excellency will be pleased to disallow the Act passed by the Legislature of the Province of Quebec, at the session of 1890, 54 Vict., ch. 15, entitled the Quebec Mining Law, humbly represents:

The petitioners, in support of their said petition, allege several reasons, which may be briefly stated as follows:

1st. The Quebec Mining Law of 1890 interferes with private rights unjustly, and confiscates private property, first by repealing Article 1425 of the Revised Statutes of the Province of Quebec and replacing it by Sub-section 2 of Section 1 of the said Act, which takes away from persons who have obtained from the Crown, previous to the 1st of July, 1890, lots of land for agricultural purposes without reservation by the Government of the ownership of mines existing on their lands, which mines, according to the common law of the Province, formed part of the land of said landed proprietors.

2nd. By taking away from the purchasers of public lands patented since 1880, and of public lands upon which phosphate mines have been discovered, patented since the 7th of March, 1878, the right of acquiring mines existing on their lands, on the condition mentioned in Articles 1428 and 1429, R.S.P.Q., that is to say, by paying to the Commissioner of Crown Lands the difference between the price of agricultural lands and that of mines.

3rd. The law, which they ask to be disallowed, is contrary to the general interest of Canada and the trade policy of the Dominion, inasmuch as it imposes a tax or duty on an important industry.

4th. This law is *ultra vires* and unconstitutional.

The Attorney General of the Province of Quebec contends that these objections are unfounded, and cannot justify the disallowance of the said Act.

I.

The pretension that the repeal of Article 1425 of the Revised Statutes of the Province of Quebec takes away from the owners of the surface, whose titles are anterior to the 24th July, 1880, the ownership of mines situated on their lands is totally erroneous, inasmuch as these persons never were owners of the mineral estates (tréfonds minéral), which might be found under the surface of their lands, as the ownership of mines never was in the Province of Quebec an accessory of the ownership of the surface. According to the old French law, mines constituted a property distinctly from the soil which covered them, and this property belonged to the Crown, and did not become private property except by an express Act of the Sovereign.

Louis XI., Avril, 1483.—Recueil des anciennes lois Francaises, vol. X., p. 911 id. tome XI., p. 97; id. tome XI., p. 666; id. tome XII., p. 771; id. tome XII., p. 196.

Henri II., Septembre, 1548.—Id. tome XIII., p. 57; id. tome XII., p. 290. Francois II. en 1560.—Id. tome XIV., p. 41.

En 1677, 1700 et 1704.—Id. tome XIX., p. 175, et tome XX., pp. 428 et 443. Louis XV., 1705.--Id. tome XX., p. 467.

Louis XV., 1716.—Id. tome XXI., p. 79.

Louis XV., 1744.—Id. tome XXII., p. 166.

Ordonnances du 30 Mai, 1413, du 3 Novembre, 1416, du ler Juillet, 1437, du 21 Mai, 1455, de Decembre, 1461, du 10 Mai, 1463, du 19 Aout, 1467, de Septembre, 1471, d'Aout, 1483, de Novembre, 1483, de Fevrier, 1483, de Janvier, 1488, de Juin, 1498, de Fevrier, 1506, et de Juillet, 1514.

Edits et ordonnances.—Vol. ler. p. 5; vol. ler. p. 45.

Edit, Juillet, 1705.

Edit, 17 Oct., 1520.

Choppin—Tome XI. du Domaine de la Couronne, titre XI. ch. 6, p. 14. Bosquet—Dictionnaire des droits domantaux, vbo. Domaine de la Couronne, vbo. Mines et Minières. Guyot—Repertoire, vbo. mines. Merlin—Rep. vbo. mines, ch. 4. Ferriere—2 vol. grand commentaire de la Contume du Paris, art. 187, ch. 10. Code Civil B.C., art. 414. Dalloz—Propriete des mines, tome ler p. 34, et pp. 226, 306, 374, 413, 452, 455, 401, 612. Locré—Législation de la France ou Commentaire des Codes Francais, tome IX., p. 107. Dalloz, ainé—Repertoire de la législation (tome XXXI.), vbo. mines et minières. Locré—Législation des mines, p. 379 et 399.

The right of ownership in mines, which belonged to the Kings of France, passed at the cession to the British Crown Such was the holding of the Court of Queen's Bench in a judgment rendered on the 7th of December, 1883, in the case of Regina vs. de Léry et al. The judgment of the Superior Court is reported in IX. Law Reports, p. 225, and that of the Court of Queen's Bench in VI. Legal News, p. 402. The heading of the report reads as follows: "By the old law of France, which is in force in Canada, the right to minerals did not pass by a grant of lands to the grantee, without special words, but remained in the Sovereign. The King of England, at the cession, succeeded to this right. The Sovereign could grant the right to the minerals to whomsoever he pleased, and, in such case, the owners of the soil had no right except to an indemnity for any damages they might suffer by the mining operations."

The British North America Act, Sec. 9, and the Civil Code of Lower Canada, re-enact, on this subject, the principles of the old law. Article 414 of our Civil Code, lays down the general principles that "ownership of the soil carries with it ownership of what is above and what is below it." But, at the same time, the third paragraph of this article makes an important restriction to the application of the above principle in the following terms: "The proprietor may make upon the soil any plantations or buildings he thinks proper. . . . He may make below it any buildings or excavations he thinks proper, and draw from such excavations any products they may yield, saving the modifications resulting from the laws and regulations *relating to mines*, and the laws and regulations of police ; that is to say, if allowed to give more precision to the reference which is here made by the legislator to certain special regulations, saving the application of the old French ordinances and of the principles of the French law, which declare that mines belong to the Crown.

The above is sufficient to show the falsity of the pretension of the petitioners that mines situated on lands patented previous to 1880, without reservation by the government of the rights of the mines, belong to the surface owners.

Consequently, it cannot be said that the Mining Act of 1890 deprives them of a right of ownership, which they never possessed.

2nd. The petitioners also pretend that the repeal of articles 1428 and 1429, R. S. P. Q., which allow purchasers of lands mentioned in these articles to buy the mines situated on said lands, by paying to the Crown the difference between the price of agricultural lands and the price of mines, constitutes a confiscation of private property. This pretension is as unfounded as the previous one.

The mineral estate (tréfonds minéral) belonging to the Sovereign, the Legislature, in the Mining Act of 1880, indicated the mode of acquiring such mines and causing them to become the property of the owners of the surface. All of these owners, who thought proper to take advantage of this clause of the law, became absolute owners of the mines on their lands, and the act of 1890 does not in any way affect them. On the other hand, such surface owners, who did not take advantage of this exceptional privilege granted them by the law of 1880, did not become owners of the mines which might be situated on their lands, and the Legislature, by changing the mode of acquiring such mines, did not confiscate anything belonging to them. Parliament is no more bound than a private individual to give perpetual existence to an offer which has not been accepted during a certain number of years.

It is also worthy of remark that the Mining Act of 1890 when fixing in articles 1463 and following the price of mines, only exercised the powers which belong to the Lieutenant-Governor in Council, under the article 1434 R. S. P. Q., and that under the previous law, the owners of the surface mentioned in said articles 1428 and 1429, could have been forced in order to become proprietors of the mines on their lands, to pay a much larger sum than the price required by the law of 1890.

Another objection to be disposed of, under the head of: 1st. The assertion by the petitioners that articles 1455-1512 inclusively, of the Mining Act of 1890, interfere with private rights and despoil private individuals of their property. This is utterly false. These articles despoil nobody and deprive no man of his property, since they are dealing exclusively with mines which have not yet become private properties.

Moreover, the mode of exploration of the soil and of working mines, laid down by these articles, existed in the statute of 1880 and in articles 1439 and following, R. S. P. Q.

II.

The petitioners bitterly complain of the imposition of a tax or royalty of 3 per cent. on the mercantile value of the products of all mines and minerals enumerated in section 1426, and declare such a tax unconstitutional and *ultra vires*.

The imposition of a tax or royalty on the products of mines cannot be a cause of disavowal of the law which imposes such a tax, as the power of imposing a tax of this nature is of the competence and within the jurisdiction of the Quebec Legislature, which alone should judge of the opportunity of imposing it, and it is not because such a tax, at a certain standpoint, affects the commerce of the country that the law which decrees it should be disallowed.

Disavowal for this cause would render necessary the disavowal of almost all the laws under which provincial taxes are imposed. Liquor licenses, timber licenses, auctioneer licenses, the law imposing a direct tax on commercial corporations, and many other of our local statutes doubtless, have a certain restrictive effect on trade and commerce. However, nobody dreamt up to this of asking the disavowal of these laws on such a ground.

It must also be remarked that the Mining Act of 1890 makes no innovation when it imposes this tax or royalty. The old French law gave the King the right to levy a royalty of ten per cent. on the products of the mines.

Regina vs. DeLéry *et al*—9 *Legal News*.

Law Reports, p. 125 and following.

And Article 435 R. S. P. Q., which re-enacted the Mining Act of 1880, gave the Lieutenant-Governor in Council the power to claim at any time the royalty due to the Crown upon any land already sold, conceded or otherwise alienated, or which might be hereafter sold.

The last argument of the petitioners for disavowal is that the Mining Act of 1890 is *ultra vires* and unconstitutional. In what mannar this Act is *ultra vires* of the Quebec Legislature, and unconstitutional, the petitioners do not see fit to state.

However, nothing can be more self evident than the constitutionality of this law. The British North America Act specifically gives to the provinces the ownership of mines, and Section 92 of the same Act gives the legislatures of the provinces exclusive power to make laws concerning them.

To sum up the question to Your Excellency, the undersigned humbly submit that the Quebec Mining Law, 54 Vict., ch. 15, which was duly assented to on the 30th December, 1890, is constitutional, has not a retroactive effect, does not interfere with private rights unjustly, nor confiscate private property, nor is it contrary to the policy of the Dominion or injurious to a large and increasing industry, but that it merely affirms the principles which were always admitted in the Province of Quebec, imposes a tax or royalty evidently within the powers of the Legislature, and in no way violates the constitution.

Wherefore, the undersigned humbly prays that the petition of A. Morrison and others, praying for the disavowal of the Quebec Mining Law, 54 Vic., chap 15, be dismissed.

(Signed), J. E. ROBIDEAUX,

Attorney-General.

QUEBEC, 31st July, 1891.

QUEBEC, 9th November, 1891.

The Honourable

The Minister of Justice,

Ottawa.

SIR,—I am directed by the Honourable the Attorney-General to inquire from you if any decision has been arrived at in the matter of the petition of A. Morrison and others, proprietors of mining lands, and persons interested in mines in the Province of Quebec, praying that His Excellency the Governor General be pleased to disallow the Act passed by the Legislature of the Province of Quebec, at the session of 1890, 54 Victoria, chapter 15, being the Quebec Mining Law, and, if not, when such a decision may be expected, and if the interested parties are to be heard before the rendering of such a decision.

I have the honor to be, Sir,

Your obedient servant,

(Signed), L. J. CANNON,

Assistant Attorney-General.

DEPARTMENT OF JUSTICE,

OTTAWA, 2nd December, 1891.

L. J. Cannon, Esq.,

Deputy Attorney-General, Quebec.

SIR,—Adverting to my letter to you of the 27th ultimo, on the subject of the Petition asking for the disallowance of the Quebec Mining Law of 1890, I beg to state that in considering the arguments of the Honourable the Attorney-General and the petitioners, it appears to the Minister of Justice that one contention of the petitioners deserves further consideration. It may be summarized as follows:

Whatever may be the law with respect to grants issued by the French Crown, before the cession in which the mines were not specifically granted, the substituted Article 1425 does not correctly state the law with respect to the patents made by the British Crown subsequent to the cession in which the mines were not expressly reserved. Such grants, it is contended, would, under the English prerogative law which governs them, include the mines and minerals other than gold and silver without their being expressly mentioned. In fact, it is contended that the whole jurisprudence of the country went to establish that where lands were granted without reserve of minerals, all baser metals became the property of the grantee.

Reading the substituted Article 1425 in connection with the definition of the words "private lands" given in the interpretation clause of the Act, it would cover all lands whether granted previous to 1880 or not, in the grant of which no mention is made of mines and minerals. It, therefore, virtually amounts to a confiscation of all mines or mining rights in such lands.

The Minister of Justice will be very pleased to receive any observations which the Honorable the Attorney-General may see fit to offer with respect to the above points.

As the time within which the Act must be reported upon will expire in a few days, I trust that I may be informed at once whether any observations on these points are to be made.

I have the honor to be, Sir,

Your obedient servant,

(Signed), ROBT. SEDGEWICK,
D.M.J.

QUEBEC, 12th December, 1891.

To the Honourable
The Minister of Justice,
Ottawa, Ont.

SIR,—I duly received the letter of Mr. Sedgewick, Deputy Minister of Justice, dated the second December instant, in which he states that, in the matter of Petitioners asking for the disavowal of the Quebec Mining Law of 1890, in considering the arguments of the Petitioners and my arguments it appeared to you that one contention of the Petitioners deserved further consideration, which said contention Mr. Sedgewick summarises as follows:

"Whatever may be the law with respect to grants issued by the French Crown before the cession, in which the mines were not specifically granted, the substituted article, 1425, does not correctly state the law with respect to patents made by the British Crown subsequent to the cession in which the mines were not expressly reserved. Such grants, it is contended, would, under the English prerogative law which governs them, include the minerals other than gold and silver without their being expressly mentioned. In fact, it is contended that the whole jurisprudence of the country went to establish that where lands were granted without a reserve of minerals, all the baser metals became the property of the grantee.

"Reading the substituted article 1425 in connection with the definition of the words 'private lands,' given in the interpretation clause of the Act, it would cover all lands whether granted previous to 1880 or not, in the grant of which no mention is made of mines and minerals. It, therefore, virtually amounts to a confiscation of all mines or mining rights in such lands."

On this point I now beg to offer the following additional remarks:—

At page 2, and following of my letter of the 31st July last, I claim to have established that "according to the old French law mines constituted a property distinct from the soil which covered them, and these properties belonged to the Crown, and did not become private property except by an express act of the Sovereign," and that the right of ownership in mines which belonged to the King of France passed, at the cession, to the British Crown. (*Vide* Treaty of Paris, 1763, Section IV., pages 61 and 62 Houston's Constitutional Documents of Canada.)

To avoid the consequences resulting from the application of this rule, the petitioners for disavowal now contend that, since the cession, mines in this Province are no longer subject to the old French law, but are governed by the public law of England relating to prerogatives of the Crown, which confers to the subject in whose lands they are discovered, all mines excepting mines of gold and silver, to which by his prerogative the King is entitled, and that the jurisprudence of this Province is unanimous on this point.

This contention of the Petitioners for disavowal, I hold to be erroneous for the following reasons :—

The mineral estate (tréfonds) in a land is by nature an immovable property, (2, Aubrey vs. R., page 11), and, as such continued, after the cession of this country to England, to be regulated by the laws in force in this Province under the French domination, as modified by our statutes, which laws were preserved to us by the capitualation, treaties and our different constitutional acts.

The Quebec Act, 1774, Sec. VIII., Houston, page 93.

The Constitutional Act, 1791, Sec. XXXIII., Houston, page 124.

The Union Act, 1840, Sec. XLVI., Houston, page 168.

The Confederation of 1867, Sec. 129, Houston, page 212.

The jurisprudence of this Province is in perfect accord with the doctrine I have just laid down, as can be ascertained by the holding in the case of Regina vs. DeLéry *et al*, already cited in my letter of the 31st July, 1891, 6 *Legal News*, page 4021 : 1st. By the old law of France, which is in force in Canada, the right to minerals did not pass by a grant of lands to the grantee without special words, but remained in the Sovereign. 2nd. The King of England at the cession succeeded to this right. 3rd. The Sovereign could grant the right to minerals to whomsoever he pleased, and in such case the owners of the soil had no right except to an indemnity for any damages they might suffer by the mining operations."

The fact that the right to mines is a prerogative of the Crown does not prevent the old French Civil Law, as modified by our statutes, to apply to mines in our Province. The prerogatives of the Crown are of two kinds: direct prerogatives, and incidental or minor prerogatives. (Bowyer, Constitutional Law, page 134.)

The right to mines is one of the minor prerogatives.

It is quite true that the direct prerogatives of the Crown are governed by the public law of England, but the same does not apply to the minor prerogatives of the Crown in this Province; they are governed by our Civil Law, which is the old French Civil Law, as modified by our Statutes.

Chitty, on prerogatives, page 25, expresses himself as follows :—

"But in countries, which, though dependent on the British Crown, have different and local laws for their internal government, as for instance, the plantations or colonies, the minor prerogatives and interests of the Crown must be regulated and governed by the peculiar and established law of the place." (Idem, pages 29-30-31.)

Our courts have several times applied this principle.

Chief Justice Reid, in rendering judgment on the 30th July, 1828, in a case of the Attorney-General pro Rege, Appellant, and Jane Black, Respondent, expressed himself as follows in the holding of the case :—

"Where the greater rights and prerogatives of the Crown come in question, recourse must be had to the public law of the Empire, as that alone by which they can be determined; but where its minor prerogatives and interests are in question they must be regulated by the established law of the place where the demand is made."

In this case Chief Justice Reid gives the following extract from Chitty:—

"That in the colonies and plantations, the minor prerogatives and interests of the Crown must be regulated and governed by the particular and established law of the place where the demand is made," and accordingly, where peculiar laws and process exist, as in Guernsey and Jersey, the King himself, in seeking to recover his own debts therein, must resort to such laws for redress." (Stuart's Reports, pages 324-25-26.)

Later on, on the 22nd December, 1874, Chief Justice Dorion, on rendering the judgment of the Court of Appeals in the case of Dame Georgiana H. Monk vs. qualité, Appellant, and the Honorable G. Ouimet, Attorney-General pro Regina, Repondent, expressed himself as follows:

"When this colony passed under the dominion of the Crown of England, the maintenance of the civil laws then in existence was guaranted by treaty. These laws, as altered by competent authorities, are still in force, and are as binding on the Crown as they were upon any of its subjects, except in cases where the higher prerogatives, which form part of the public law throughout the whole Empire, are affected. The right to be paid in preference to other creditors of a common debtor does not form part of the higher prerogatives of the Crown, which are part of the public law, but belong to what are termed the minor prerogatives, those which are not essential to the supremacy of the Crown, and which are controlled by the *private or municipal law of that part of the Empire where they are claimed.*

"Vide also Chitty on Prerogatives, 25, 29, 31; Chamber's Colonial Opinions, 88, and Attorney-General and Black; Stuart's Reports, 324, where this rule has been followed."

I respectfully submit that the above authorities establish beyond doubt that in our Province mines are regulated by the old French Civil Law, as modified by our statutes.

The contention of the Petitioners for the disavowal, that our courts have invariably held that the ownership of mines on lands granted before 1880, without reserve of mines thereon by the Crown, belong to the surface owners, is absolutely unfounded. The Petitioners do not cite a solitary decision in support of this alleged jurisprudence, for the obvious reason that no such decision exists. The few reported decisions on this question amongst which that of Regina vs. de Léry, already cited, absolutely lay down a doctrine contrary to that claimed by the Petitioners.

Wherefore, I respectfully persist in praying that the Petition of A. Morrison and others, for the disavowal of the Quebec Mining Act, 54 Vict., chap. 15, be dismissed.

I have the honor to be, Sir,

Your obedient servant,

(Signed), J. E. Robideaux,

Attorney-General.

To the Honourable OTTAWA, 16th December, 1891.

J. E. Robideaux,

Attorney-General.

MY DEAR ATTORNEY-GENERAL,—I am much obliged for your letter of the 12th instant, having reference to the petition for disallowance of the Quebec Mining Law of 1890.

Will you permit me to say that I am still far from being convinced that Crown grants in your Province, since the cession, have the limited effect which you claim they have, and I am likewise somewhat in doubt as to the limited character of Crown grants issued prior to the cession. The statute under consideration makes the statement that "*it is admitted that mines, whether upon private or public lands, belong to the Crown.*" If the legislation in question were really based upon an admission, it ought to appear that the person making the admission had authority to make it from those who would be affected by it. It seems clear, however, both from the statute itself and from the correspondence, that your Legislature intended to legislate in respect only to mines which, as a matter of fact, belonged to the Crown. I may be excused for suggesting that all difficulty might be removed by an amendment making it clear that the Act only applied to mines and minerals which belong to the Crown, without making any specific declaration that this includes all minerals in lands granted by the Crown although not specifically reserved. In that case the legal questions which have been raised, and in respect of which there may, I think, be considerable doubt, would be left for determination by the courts. Such an amendment it appears to me, while in no wise impairing the just rights of the Province, would remove any objection to the Act on the ground of its being a confiscation of existing private rights as claimed by the Petitioners. An assurance from you that your Government, at the next session of your Legislature, would promote an amendment to the effect suggested, would materially aid me in making my report to His Excellency in Council on the subject of the Quebec legislation of last session.

Believe me,

My dear Attorney-General,

Faithfully yours,

(Signed), J. S. D. THOMPSON.

To the Honourable QUEBEC, 18th December, 1891.

Sir J. S. D. Thompson,

Minister of Justice,

Ottawa, Ont.

SIR,—I have the honour to acknowledge the receipt of your letter of the 16th instant, to the Honourable the Attorney-General, in the matter of the disavowal of the Quebec Mining Law of 1890.

I have the honour to be, Sir,

Your obedient servant,

(Signed), L. J. CANNON,

Assistant Attorney-General.

OTTAWA, 22nd December, 1891.

The Honourable

T. Chase Casgrain,

Attorney-General,

Quebec.

MY DEAR ATTORNEY-GENERAL,—I beg to enclose you copies of certain papers and correspondence having reference to the disallowance of the Quebec Mining Act of last session of your Legislature. You will observe that my last letter to your predecessor was written on or about the day when he ceased to be Attorney-General, and I have not received any reply from him. I send the whole correspondence to you in the hope that I may be able to obtain from you at an early day an assurance that the Act will be amended at the next sitting of your Legislature in the manner I have suggested.

Yours faithfully,

(Sgd.) J. S. D. THOMPSON.

CABINET DU PROCUREUR GENERAL, PROVINCE DE QUEBEC,

QUEBEC, December 23rd, 1891.

The Honourable

Sir J. S. D. Thompson, K.C.M.G.,

Minister of Justice,

Ottawa.

DEAR SIR JOHN,—I beg to acknowledge receipt of your favor of the 22nd inst., enclosing copies of certain papers and correspondence having reference to the disallowance of the Quebec Mining Act of last session. I will attend to the matter immediately.

Yours faithfully,

(Sgd.) T. CHASE CASGRAIN.

DEPARTMENT DU PROCUREUR GENERAL,

QUEBEC, 8th January, 1892.

The Honourable

Sir J. S. D. Thompson,

Minister of Justice,

Ottawa.

MY DEAR SIR JOHN,—Referring to your letter of the 16th December last, addressed to the Attorney-General of this Province, and having reference to the petition for the disavowal of the Quebec Mining Law of 1890, after having submitted the same to my colleagues, I am authorised to inform you that we have come to the following conclusion as regards the proposal you made in the above-mentioned letter in the following terms :—

"I may be excused for suggesting that all difficulties might be removed by an amendment making it clear that the Act only applied to mines and minerals which belong to the Crown although not specifically reserved. In that case the legal questions which have been raised, and in respect of which there may, I think, be considerable doubt, would be left for determination by the courts."

Without in any way waiving any rights this Province may have to legislate on this matter, and without prejudice to said rights, this Government pledges itself to promote at the next session of the Legislature of this Province an amendment to the said Quebec Mining Law of 1890, to the effect suggested by you as above.

Should you not find this letter a sufficient assurance to enable you to make your report to His Excellency the Governor-General-in-Council on the subject of the Quebec Legislation of the last session, this Government is ready to pass an Order-in-Council to the same effect..

I remain,

Yours very truly,

(Sgd.) T. CHASE CASGRAIN,
Attorney-General.

CERTIFIED COPY OF A REPORT OF A COMMITTEE OF THE HONOURABLE PRIVY COUNCIL, APPROVED BY HIS EXCELLENCY THE GOVERNOR-GENERAL-IN-COUNCIL ON THE 12TH JANUARY, 1892.

A Committee of the Privy Council have had under consideration the annexed report, dated 8th January, 1892, from the Minister of Justice, upon two Acts passed by the Legislature of the Province of Quebec, in the session held in the year 1890, namely:

Chapter 15—An Act to amend and consolidate the Mining Law; and

Chapter 22—An Act respecting the Court of Queen's Bench, Crown side.

The Committee concur in the said report and the recommendations therein set forth, and advise that the Secretary of State be authorized to forward a copy thereof and of this Minute, if approved, to the Lieutenant-Governor of the Province of Quebec.

All of which is respectfully submitted.

(Signed), JOHN J. MCGEE,
Clerk of the Privy Council.

EXCERPT OF REPORT FROM THE HON. J. S. D. THOMPSON, MINISTER OF JUSTICE, TO HIS EXCELLENCY THE GOVERNOR-GENERAL-IN-COUNCIL.

OTTAWA, 8th January, 1892.

To His Excellency

The Governor-General-in-Council.

The undersigned has the honour to report on two Acts (Chapters 15 and 22), passed by the Legislature of the Province of Quebec, in the session held in the year 1890, as follows;

Chapter 15—An Act to amend and consolidate the Mining Law.

This Act is a consolidation and amendment of the Statute Law of the Province of Quebec in relation to mines. It purports to impose a royalty upon the mines therein mentioned, the royalty upon gold and silver being 2½% on the gross weight, and on the other minerals 3% on the merchantable value. The Act contains the following clause:

"1425—As it is admitted that mines, whether upon public or private lands, belong to the Crown, any person discovering a mine may purchase the same by complying with the provisions of this section.

"Upon private lands, the occupant of the surface has the first right to purchase such mine upon the conditions imposed by law and the regulations;" and Section 8 (1421), provides that "the words 'private lands' designate all lands conceded or otherwise alienated by the Crown, other than mining concessions or lands conceded by the Crown as such."

The undersigned has annexed to this report a petition addressed to Your Excellency from a number of gentlemen interested in mining lands, together with correspondence between himself and the Attorney-General of the Province of Quebec, having reference to the prayer of that petition.

In view of the assurance contained in the communication dated the 8th instant, from the Honourable Mr. Attorney-General Casgrain, the undersigned has the honour to recommend that this Act be left to its operation.

* * * * * * *

Respectfully submitted,

(Signed), J. S. D. THOMPSON,
Minister of Justice.

HON. GEORGE IRVINE—I have only heard the papers read for the first time to-day, and I may say that in my opinion the result is satisfactory. I think we have reason to be satisfied with the result of our negotiations.

CAPT. R. C. ADAMS—As far as I can judge, the report is hardly a satisfactory solution, because it leaves the question open. We simply have the assurance that we may fight the matter in the courts.

HON. GEORGE IRVINE—What we were fighting for was to prevent the Legislature from taking away our titles. If the Quebec Government carries out the promise contained in the correspondence we shall have been successful in our contention.

CAPT. ADAMS—Still the fact remains that there is a question of conflict between the Dominion and Provincial Governments as to whether private owners of land have a good title. It makes public a very serious difficulty.

MR. S. P. FRANCHOT—Do I understand that this retroactive part of the Act is to be annulled?

HON. GEORGE IRVINE—Certainly.

MR. FRANCHOT—Do I understand that each individual will have to defend his title against all comers—the law is not laid down that mines upon private lands belong to the Crown?

HON. GEORGE IRVINE—No.

MR. FRANCHOT—Now if the retroactive clause of the Act be annulled, does it not give standing ground to say that they have no right to put a royalty upon such lands.

HON. GEORGE IRVINE—Royalty is only another name for tax. It is an incorrect expression.

CAPT. ADAMS—With reference to what Mr. Franchot has said, it seems to me that while things are left in *statu quo*, the whole statute is an uncertain one.

HON. GEORGE IRVINE—It is made uncertain by the Attorney-General of the Province of Quebec.

MR. FRANCHOT—Do they recognize it as an open question? They may do so; we don't. Suppose we invite capitalists to invest in the Province we must have the point decided beyond a peradventure.

HON. GEORGE IRVINE—The Act would only refer to land granted for agricultural purposes prior to 1880. There is no doubt about land subsequent to 1880, and with regard to phosphate, two years before—I think 1878.

MR. THEO. DOUCET—Still the question is one which is open to doubt.

HON. GEORGE IRVINE—We cannot help that.

MR. THEO. DOUCET—The all-important point is what effect will the present situation of affairs have upon the investing public?

HON. GEORGE IRVINE—The onus is thrown upon the local Government. It will have to prove its position.

MR. THEO. DOUCET—Still it will have a deterrent effect upon the introduction of capital.

HON. GEORGE IRVINE—I am afraid that is inevitable.

COL. LUCKE—The titles to the lots held by our company, which I have read over very carefully, reserve nothing to the Crown except pine timber of a certain size.

HON. GEORGE IRVINE—But yours is a mining grant; you will find that it is registered as such.

MR. L. A. KLEIN—In the event of the present Government being defeated at the ensuing elections, will the succeeding administration be bound to carry out this Order-in-Council.

HON. GEORGE IRVINE—I take it that whatever Goverment is elected will be bound to do so.

ELECTION OF OFFICERS AND COUNCIL, 1892-3.

The following were elected officers and council for ensuing year:—

President:
HON. GEORGE IRVINE, Q.C., Quebec.

Vice-Presidents:
Capt. R. C. Adams, Montreal,
R. Prefontaine, Q.C., M.P., Montreal,
S. P. Franchot, Buckingham,
James King, M.P.P., Quebec.

Treasurer:
A. W. Stevenson, C.A., Montreal.

Secretary:
B. T. A. Bell, Ottawa.

Council:
D. A. Brown, Boston,
John J. Penhale, Bear Lake,
O. M. Harris, Montreal,
Col. Lucke, Sherbrooke,
J. Lainson Wills, F.C.S., Ottawa,
J. Burley Smith, Glen Almond,
Dickson Anderson, Montreal,
R. T. Hopper, Montreal,
L. A. Klein, Montreal.

It was decided that the next meeting of the Association should be held in the Eastern Townships in June, date, place and programme to be arranged by the following sub-committee: Messrs. L. A. Klein, Col. Lucke, and John J. Penhale.

Messrs. S. P. Franchot, O. M. Harris, J. Lainson Wills and J. Burley Smith, were appointed a sub-committee to arrange for the September meeting.

This terminated the morning session.

AFTERNOON SESSION.

The members re-assembled at two o'clock, the Club Room being crowded, a pleasing feature being the presence of a large number of students attending the mining, engineering and applied science lectures at McGill University. Capt. R. C. Adams, in the absence of the president, occupied the chair.

TECHNICAL EDUCATION IN RELATION TO MINING.

SIR WILLIAM DAWSON—I propose merely to say a few words respecting our mining course in introducing Prof. Carlyle, who, I hope, will address you at greater length on the subject. The course of Mining Engineering in our Faculty of Applied Science was introduced about twenty years ago, under the able management of Dr. Sterry Hunt and Dr. Harrington, and has been one of the most successful in its results. Our aim has been to furnish all-round men, who, with a little practical experience should be able to make themselves useful in mining, mineral exploration and surveying, assaying or metallurgy. To secure this end, the course of study extends over four years, and includes those portions of the civil and mechanical engineering courses which are useful to mining engineers, as well as a thorough training in chemistry, assaying, mineralogy and geology; besides the special instruction in mining and metallurgy now given by one of our own graduates, Mr. Carlyle. The results have been very satisfactory in so far as the graduates are concerned. They have proved themselves useful, practical men, and have also shown a capacity and inclination to pursue original research in geology. Unfortunately, the demand for such men in the United States and other countries has been so great that but few have remained in Canada. This we specially regret, as we believe our own young men trained here are better suited than others to the work of developing our mineral resources. It is hoped, however, that as the number of our graduates increases, more of them may be induced to remain. On the whole, it may be affirmed that no professional men educated at McGill have been more certain of remunerative employment or more useful than our mining engineers.

PROF. W. C. CARLYLE—Having but recently returned from that great mining State, Colorado, where the last few years have been spent in work as a mining engineer in one of the most progressive and wealthy mining centres, I find myself once more in Canada, among Canadians, and one of the faculty in engineering at McGill University. Having taken the course in mining at this college before leaving for the west, and having since then been associated very intimately in extensive mining operations with men of wide experience, this good opportunity has been taken to learn while working with other engineers and practical mining men, the real use or value to a mining man of a technical education.

We are all conscious of the feeling of suspicion and animosity towards young college-trained men, felt by many of those who, through years of constant practical work in mining, have gained large experience and also reputation; felt even by those not so familiar with its details and demands. It must be confessed that many college men have deservedly brought this distrust upon themselves, though unjustly upon their colleagues, by not having worldly wisdom enough to perceive that their book-lore and college training were not all-sufficient to make them thorough mining men, without having, as well, worked in the mill or smelter, or underground, with skilled and knowing millmen or miners having the countless but all-essential details that only such experience can give. Some such have undertaken, with too great self-confidence, operations far beyond their ability and practical knowledge, incurring certain failure and nonfulfilment of that they had glowingly promised. Fortunately, we are glad to say, this prejudice is fast being proved unwarrantable, mostly through the efforts and actions of collegians themselves, who, more wisely, on leaving college halls, have at once quickly sought out mining districts, and working with experienced men, having the all-important practical part, have made themselves, in many instances, men of pronounced success and reputation in the mining world.

We might now ask, what comprises a technical education in mining, as given at a well equipped college? In the first place some subjects as given in the general course of education are taugnt, but chief prominence is given to subjects pertinent to the mining course, as mathematics, physics, chemistry, assaying and drawing. Besides laboratory work, the student takes up surveying in all its branches, surface and underground, and, proceeding, studies, theoretically and practically, mineralogical geology, which, to any mining man, in their real practical use in the daily prosecution of his work, cannot be overestimated. For, in the first place, he can correctly determine the rocks and minerals of his mining district, and being already versed in the history of similar formations, as carefully worked out by geologists in other parts, he is prepared already as to what to expect in his own mine or locality. Better still, acquainted with the general laws of rock formation; the occurrence and relationship of the different rocks to each other; the habits of slips and faults so often met with in mining; the peculiarities and the probable origin of the veins and ore bodies, and what marvellous geologic changes have taken place and are possible—the floors of former oceans now lifted up to summits of lofty mountains, or lying all twisted and rent—all this knowledge helps him to arrive at more accurate conclusions, and to avoid following theories and ideas entirely absurd and wrong. Of this last fact the writer has often been impressed, even amazed, while working among old and experienced miners, whose geological education had been gleaned from what they themselves had seen, to hear their very fantastic and impossible explanations of peculiarities in ore bodies and formations. Geology is not a theoretical or ideal study, with constantly changing argument and classification, but yearly it is becoming more and more a valuable practical science and strong factor in an engineer's training.

In Leadville, about ten years ago, Emmons, the famous geologist of the United States Geological Survey, made as complete and exhaustive examination as then possible of that wonderful silver mining camp, unravelling the intricacies of the systems of faultings, and reaching such definite conclusions as to the relationships between the ore bodies and the enclosing limestones and porphyries, as were explained in his monograph with its accompanying maps and sections, that these have become the guide to all classes of miners, who have been compelled to acknowledge the usefulness of his researches, by the wonderful manner in which subsequent developments have proved the correctness of his views.

Other subjects of equal importance to a mining engineer are taught, such as applied mechanics, hydraulics, steam, electricity, construction and designing, and so well equipped are our colleges becoming that a man is not confined to book work and the lecture; he can now work with the mechanics himself, test and compare the strengths of materials of construction, and experiment with different forms of structure. In mining itself he is told of the best methods of work, of the best and cheapest kinds of machinery for hoisting and pumping, of plans for dressing ores, and their transportation.

Through the great liberality of Mr. McDonald and other friends of the University, the engineering department at McGill will soon be able to offer young men entering this profession facilities of instruction unsurpassed in America. With their large buildings, completely equipped with extensive workshops, testing machines and laboratories, and with a corps of experienced men as professors and instructors, the student graduating here as an engineer will have had a course eminently fitted to help him very materially in his after work. It is hoped and expected that before so very long the University will be able to erect and fully equip a metallurgical department, to be used in teaching metallurgy, practically, just as it would be seen in the mills, and in testing to determine the best and cheapest process of treatment for any particular ore. Such a laboratory will be supplied with regular machines, such as rock crushers, rolls, stamps, amalgamating plates and pans, vanners chlorinating and leaching plants, concentrating machinery, and the different furnaces for calcining, roasting and smelting. With such equipments, not only will our students become thoroughly acquainted with the different systems of treating ores, learning practically how to handle the ores and different machines; but mining men throughout the Dominion, desirous of learning the proper method to adopt in building a mill to treat their ore, will thus be able to have their ores systematically treated by the different processes, thus determining the method, the cheapest and best adapted.

A young man having thus taken a technical course in mining, will leave college educated, and familiar with surveying, assaying, analyzing, geology and mineralogy, with more or less experience in developing and working a mining property, and afterwards correctly treating its ores. If a man, capable and intelligent, with such a training, will complement this knowledge by at once entering and studying the strictly practical part of his work, going, if needs be, to the great mining centres of the other side, where mining and metallurgy are reaching such a high state of progress, such a man, thus doubly equipped, cannot fail but be a success in his profession, and a benefit to the locality where he labors. That such a training is valuable cannot be better evidenced than by the fact that in the large mining schools of the west the majority of the students are sons of mining men, who, having felt themselves many times hampered by the lack of such an education, are giving these young men the valuable opportunity which was denied to them. Again, throughout the west, by far the most of the best economical and scientific mining is being done by engineers and mining men who have had technical education. The writer is well warranted in this statement.

In Canada our mining is as yet but just begun, thwarted as it is by defective and senseless laws. But the time will surely come when mining will be an institution of our Dominion, in economic as well as precious minerals, and men with both technical and practical experience will help in its development, encouraging capital to venture, and then making good its venture. With this great increase in the mining industries, Canada will receive large additions to her income, making her stronger and wealthier, as her great resources promise that she shall be in the not far distant future.

MR. B. T. A. BELL—For the benefit of Sir William, Prof. Carlyle, and the students who were not with us at our morning session, I would like to say that the Association will always cordially welcome the students of mining engineering and the professors at McGill, to take part, not only in the meetings and discussions of this Association, but also in the excursions to mining districts, where an opportunity may be had by the students of studying the methods of winning and treating the various mineral products of the province.

The Chairman then called for the paper on

CANADIAN PLATINUM.

By J. T. Donald, M.A., Montreal.

It has long been known that platinum had been found in the Province of Quebec. In the Report of the Geological Survey for 1851-52, it is stated that Dr. Hunt had detected native platinum in some of the gold washings of the Chaudiére district.

In the Province of Ontario, platinum has been discovered in the Sudbury district. It there occurs in combination with arsenic, forming the mineral Sperrylite, which is of great interest, as it is "the first mineral yet found containing platinum as an important constituent other than the natural alloys with various metals of the platinum group." So far as can be learned, no effort has yet been made to utilize Sperrylite as a source of platinum, but at present it brings a high price as a mineral curiosity. Canadian platinum ore, as a commercial article, is entirely the product of British Columbia. In association with alluvial gold it has been met with in a number of the streams of that Province. At present the most important platinum-bearing district of British Columbia, as well, indeed, as of North America, is that of the Tulameen or North Fork of the Similkameen River. Placer mining in this district yields both gold and platinum, the latter being found, like the gold, in grains and small nuggets. A notable quantity of platinum has already been obtained from this district. One firm in the United States claims to have purchased within the last year or two fully 2,000 oz. of British Columbia platinum, and it is well known that a portion of the yield of this district has found its way to the London market.

An increased output may be expected, as the Tulameen Hydraulic and Improvement Co. have made preparations to begin hydraulic mining on a large scale with the advent of spring. Mr. R. G. Tatlow, a member of this company, informs me that his company has erected a saw mill, having a capacity of 5,000 feet per diem, and has constructed about two miles of flume, 5 feet at base, 20 inches high, on sills placed on solid bed about 7 feet wide, and having a grade of ½ inch in 12 feet. The water is taken from Eagle Creek, about 14 miles above Granite

Creek, the only creek capable of giving the necessary quantity of water and pressure. In addition to this flume, the company has on the ground and ready for work, about 400 feet of iron pipe and a monitor, which, where work is to be commenced, will work with a pressure of 900 miners' inches, and a drop of about 160 feet. Mr. Tatlow also states that the largest yield of platinum appears to have been in the vicinity of and below Eagle Creek, where the yield has been about two parts of gold to one of platinum.

The two samples of this Tulameen ore before us contain, 69.28 and 72% platinum.* It is really a very complex alloy of platinum, with a number of the comparatively rare metals of this group, such as palladium, iridium, and notably an alloy of osmium, and iridium, known as osmixidium, which in grains of proper size and form is used for pen points. This ore is worth to-day about $5.50 per oz. troy. The price is very unsteady, being determined by the demand for the metal, and by the state of affairs in Russia, the principal producer of the ore.

The value of platinum depends chiefly upon its ability to resist high temperatures and the action of the majority of chemical re-agents. Its value to the chemist is well expressed by Liebig's statement: "Without platinum it would be impossible in many cases to make the analysis of a mineral; * * without platinum the composition of most minerals would have yet remained unknown." In the forms of foil and wire, and wrought into crucibles, evaporating dishes, etc., it is in constant use in the laboratory; but its use is not confined to the laboratory. It is employed on a large scale in manufacturing chemistry, for example, in the concentration of sulphuric acid.

In 1888, platinum in the form of pans, retorts, etc., to the value of $12,268, was imported into this province, and it is understood that practically the whole was imported for use in the sulphuric acid works in Capelton.

Dr. D. T. Day, in "Mineral Resources of the United States," 1887, states that a use involving a large and steady consumption of platinum wire is for stems on porcelain teeth. It is estimated that 40,000 oz. of platinum are thus consumed in the United States yearly. In the form of wire it is also used to a large extent in electrical appliances.

*A complete analysis of ore from Granite Creek appears in the Report of the Geological Survey for 1886.

An interesting statement in connection with the metallurgy of platinum was made by the president of the chemical section of the British Association, at the meeting of last year. It is to the effect that one firm of refiners in London have such facilities that 2½ cwts. of platinum may be melted in a single charge, and that the same firm in a single operation, extracted a mass of palladium valued at £30,000 from gold platinum ore actually worth more than a million sterling.

HON. GEORGE IRVINE in the chair.

MINING LUCK.

By CAPT. R. C. ADAMS, Montreal.

I fear it will seem sacriligious for me to intrude upon this meeting, where we have heard so much of scientific wisdom from eminent men, with considerations of the pecuniary results of mining operations. But perhaps the turning of our thoughts in this direction for a few moments may afford some diversion and may enable us the better to consider the serious topics which have been presented to us, and those that we are yet to receive.

Under our present competitive system in which we earn our living by exploiting the pockets of others, the motive of those who engage in mining is not primarily to supply the world with minerals as a philanthropic effort, but to make money for themselves. The practical question of mining, to those of us who engage in it, is, ultimately, how much of the contents of the mineral pockets and veins can be transferred to our own pockets?

The mining industry is doubtless one of the most beneficial in the world and adds directly to its wealth, but we do not follow it because it is a service to mankind, but to benefit ourselves, and although this may be called a sordid view, it is the fact that the pursuit of mining depends upon its profit. I, therefore, feel that it is quite legitimate that we should turn our attention this afternoon to the topic of Mining Luck, and by luck is meant the result of circumstances beyond our control.

Statisticians tell us that in commercial enterprises three per cent. of the people are successful, and that ninety-seven per cent. fail. I am not sure how accurate that is, but I have read in Chambers' Encyclopœdia that ninety-two per cent. of the mining capital in the United States has been sunk, only eight per cent. realizing, so that any one can see that the mining people were five per cent. ahead of the commercial men. I do not know whether this would apply to Canada.

I was standing before a vein of mineral a few months ago, and predicting a large output from it, when the manager turned to me and said: "I have been engaged in the course of my life in almost every mine in Canada, and I have never known one that has succeeded." I thought that he was talking in a very hopeless way, but I can only say as a result, that the vein I looked at did not succeed, and added one more to his disappointments.

Success in mining operations has not been always due to the extent of the mineral deposits. We know that a good deal of the profit that has been made in mining operations has been made by deals in shares. A mining engineer, who was employed in the Comstock mine, told me that some of the fortunes from that wonderful lode came, not from the ore that was got out of the mine, but was got by operations in the shares; and he tells me that when a remarkably rich vein was met, in some cases it was secretly guarded; sentinels were put on the mine and work was done designedly in poor ore; the dividends going down, of course the shares went down, and the people in control bought them. Then the original veins were opened up, and great profits were made, and large dividends were declared, and when the stock had gone up to remarkable figures these people unloaded it. I do not know how accurate this account may be, but from all I have heard there seems to be some truth in the statement that many of these great fortunes that we hear of have been made, not altogether from the pockets of ore, but out of the pockets of the credulous public. We know, too, that a great many of the operators in mines—the discoverers, the men to whom we really owe the exploitation of this wealth—have not reaped the benefit; for, like inventors, they very often fail to derive the benefit of their work.

It is said that Marshall, who discovered gold in California, died a pensioner of the State. Colton, the discoverer of the Bobtail lode of Colorado, settled down upon a little ranch on the Platte River. Comstock, died in poverty in Montana. This has been the history of a large number who have been instrumental in opening up the veins of ore.

We know that the men who have invested in many of these enterprises have been unsuccessful. Once I had the temerity to ask a Boston man to invest in mining near Ottawa, and he said, "Do you think we are going to put our money in the wilds of Canada? We prefer to invest at home, in Colorado or Montana." But one gentleman whom I accosted, quietly went to his safe and handed me a package, saying that it represented in mining certificates a half million dollars which an old gentleman had quietly invested on the sly, and he said that of all this half million dollars only one company had ever paid a dividend. That was his experience concerning mining investments; but he did have something, he had the most wonderful collection of engravings that I have ever seen; the certificates were covered with rising suns, moons, stars and mining devices, and it was a very beautiful display of artistic work. I remember the remark of the president of a Boston bank to whom I also spoke in the same way. He said, "I would not invest a dollar in digging if the chance was offered to me by the Angel Gabriel," which shows the impression that had got abroad in reference to mining enterprises. One of these gentlemen, who was a large shipowner, told the captain who had charge of one of his vessels, that misfortune was a fault in nine cases out of ten. He did not believe much in luck.

This same man sent out his ship loaded with a cargo of ice, in command of this young captain, and three days out from Boston the ice ship caught fire. He discharged the captain, and told him that although it was not his fault, a young man on his first voyage ought to be lucky.

I would like to mention, as I have spoken rather discouragingly of investments in mining, of what luck has done for miners, that we may take perhaps a little encouragement from some of their experiences. I remember once seeing Mr. Woodward, in San Francisco, and learning these particulars of his history: He was engaged with a pair of mules in transporting goods to the mines, and one day a couple of miners came out "dead broke." They said they had a claim which they had been working unsuccessfully, and that they had abandoned it. The driver was also disheartened, and said that there was also very little money in his business. These miners offered to give up their claim for his mules, and he decided to take the venture. He changed his mules for the mine, and it turned out to be the famous Gould and Curry mine, the shares of which were sold at over two thousand dollars each. The man who went it blind, and changed two mules for a mine, became a millionaire.

You have all heard of the Sarah Sands nugget of Ballarat, Australia —the Welcome Nugget, as it is called, a model of which can be seen in some of our museums, which weighed 233 pounds 4 ozs. troy, and was worth about $54,000; and another discovered in Donolly District, Australia, in 1869, which weighed 2,520 oz. and was valued at £9,600.

A good many stories are told of the Welcome and other large nuggets which may have some foundation, showing that it was an element of luck that in a great measure secured their discovery. It was stated of this great nugget that three miners were working in the vein, and being discouraged they had determined to work one day more and then cease. The evening had come and they were going to leave when one man took up his pick and said "One more stroke for luck." He struck and saw something gleaming; the others saw that he had found something and joined him, and in a little while they brought out this immense nugget. Another version I have heard of this story was, that one of these men was a sailor who had run away from his ship and had gone to the mines. He afterwards went back to Melbourne and there was accosted by the captain of the ship, who wished to arrest him as a deserter. He told the captain he would pay him off. So he bought the ship from the agents and went home captain himself.

I have read that in Colorado a man prospecting discovered a mine, and thought he was very fortunate in a little while in selling it to four men for twenty-five thousand dollars. The persons to whom he sold it worked it, and all at once found they had an immense deposit of silver. The result was that after clearing several millions they sold the mine for thirteen million dollars, and at the time they sold it it was stated that there was thirty-seven million dollars in sight. That was the famous "Horn" silver mine.

Last spring, in London, I was told by some of my friends that about three years ago they purchased ten thousand shares of a run-down Colorado mine for sixpence a share. They went to work on it and in two or three months came across large bunches of silver ore. Those shares that they paid sixpence for are now selling for three pounds a share, and dividends of 40, 60 and 80 per cent. have been paid. The mines were at Ouray, Colorado: the New Gunstan, the Yankee Girl, and the American Belle. It is seemingly to luck that they owe these great awards.

I have been told that the largest show that they ever had in the famous "Emerald Mine" was found when a man, in skylarking, pushed another against a tree stump, which turned up and showed phosphate at the roots. This, being followed, led to the largest show that they ever had there. We have seen the element of luck lately in our phosphate mines, which, owing to the competition of Florida phosphates, have become unprofitable. Many of our mines have been troubled in the past by dark coloured mica, which was worthless and an injury to the quality of the phosphates, and had to be thrown away. But all at once it was discovered that this is a most valuable electrical insulator, and some mines will be able to keep open by the combination of phosphate and mica mining.

It is sometimes stated that mining is gambling with God; the people bet that there is a certain thing in the ground. They are betting against nature; and mining is gambling. But money which is spent on it is not really put in a hole in the ground, for even if not profitable the money goes into the pockets of deserving people—people who are working hard. It promotes a great many contingent interests in the country, and the men who have not made profits themselves, may certainly feel some satisfaction at the benefit resulting from their investments that the money spent in this way developed the country and benefited directly a great number of worthy people.

There is one great encouragement, I think, from this element of luck in mining, which is that ability is not essential to success as it is in some other departments. If one desires to be eminent in geology, as Sir William Dawson; or in chemistry, as Doctor Harrington; or in mechanical arts, like many of our friends; we know that a great amount of intelligence and brains, as we say, is necessary—that it is a matter of learning and skill. But almost any average person may become a successful miner. Learning is not by any means excluded from the field, for no doubt, as Professor Carlyle has told us, those with a technical education succeed best. In mercantile circles we know that a man must be shrewd, but even if he is not so, there is a chance for him in mining if he only has the elements of courage and perseverance.

A miner has to be industrious and persistent in intelligent effort, and he must not be discouraged even if people tell him that he is dropping buckets into empty wells and growing old in drawing nothing up, that he is a crank and that he is beating his head against a stone wall. In spite of this a miner must be a man who will never say die while he has a shot in the locker; he must not know when he is beaten, and must not despair when he is down on his luck. He must have tact, perseverance and hope, and he must remember that although there is a good deal of chance in his undertakings, the words are true which have been written by Oliver Wendell Holmes:—

> "Be firm! one constant element in luck,
> Is genuine, solid, old Teutonic pluck."

MR. H. S. POOLE, F.G.S., Stellarton, having been called on said:—I am in the unfortunate position of one who is employed and does not look to the profits for his pay, but I am afraid from the experience of that section of the country from which I come (Nova Scotia) that it is perhaps a safer position to take. I have experienced great interest in listening to the last paper, because it reminds me of a little experience in the west some time ago: We were going into a small mine which was practically abandoned, and where there was one man working, and as I went round I put one or two samples in my pocket, and after returning to my own locality I made several assays, and to my surprise after working it over I found a large proportion of silver, and it turned out that the lumps I had taken out were worth some three or four thousand dollars to the ton. The result was that the mine was sold to the man who took me round, and who was "dead broke" at the time, and he got eighteen thousand dollars for it. As regards the coal mining generally, I don't think I have anything to say. I have had great pleasure in listening to what has been said, and in enjoying the society of the members, since you have kindly given me the invitation to be present.

THE IMPORTANCE OF A KNOWLEDGE OF GEOLOGY AND ITS KINDRED SUBJECTS TO THE MINING ENGINEER AND PROSPECTOR.

By Dr. Robert W. Ells, Ottawa.

Few professions probably call for a greater amount of clear-headedness, or for the exercise of that faculty, enjoyed unfortunately by certain persons only, of taking a clear but comprehensive view of all sides of any problem which may be presented, than that of mining engineering. For not only must the mining engineer become the guardian and trustee of great and important interests, comprising frequently the investment of millions of dollars of capital, and the employment and general oversight of hundreds of men, but he must, by the shrewdness of his judgment, and by the exercise of the skill which he may have acquired either by dint of hard labour and experience in the pursuit of his profession, or by the acquaintance, in the first place, of the accrued knowledge of the school, be prepared, both to direct properly the expenditure of the funds intrusted to him, in the way which shall return the greatest possible amount of profit to the investors, either directly or in such a way as shall lead to large future dividends, and to provide as well for the welfare of the men under his control. To do all this requires the possession of several very important attributes, among which may be mentioned a good stock of plain common sense and the ability to use it, sound judgment, clear and quick powers of perception; and, in order that all these may be most profitably directed, a thorough preliminary training with technical matters pertaining to his profession. Granted that our mining engineer is equipped with the requisites just stated, it is needless to remark that the accomplishment of such desirable results as are anticipated by every board of mine directors, must still depend upon several conditions, while primarily it may be said that very much of the success to be hoped for will depend upon the amount of skill enjoyed by the guiding spirit of the work in hand. A still more important factor as regards the success of such operations is the selection of a proper location, which shall contain a sufficient quantity of mineral matter to warrant the outlay of the capital contemplated, without which, indeed, the most surpassing skill of the mining engineer will be of but little avail.

The deposits of the metallic minerals which are stored up within the earth's crust are arranged with regard to the operation of certain well recognized principles. That all these have yet been ascertained is too much to hope for, but it can be safely asserted that very much valuable information of vast practical benefit in regard to the mode of occurrence and distribution of our principal economic minerals has been obtained, and from these a series of carefully drawn conclusions are now available for those who choose to employ the most fitting instruments in the search for the world's mineral wealth.

In the location and development of our mining centres, we should consider, prior to the operations of the mining engineer, the work of the mineral prospector, who may be justly regarded as the pioneer in most mining enterprises; for while it must be stated that the determination of mineral horizons, the conditions of mineral occurrence, and the prospect of successful working or otherwise, are questions which more particularly come under the consideration of the scientific explorer, to the prospector, as a class, it must be confessed that the credit of finding most of our workable seams is due. In the prospector himself we have a wide range, not only as regards the capacities of the individual, but as relates to the method employed in the search for mineral deposits. Thus in the old book of Agricola we find curious illustrations of this class of men, engaged in the attempt to find mineral veins by the aid of the divining rod, called also the *dowsing* or *mineral* rod. Many of you may suppose that this strange instrument of so remote a time should have long since passed into disuse, but such is not the case, for in most countries, even at the present day, the use of the divining rod in the search for mineral veins, buried treasure, and for finding water, is still common. The belief in its efficacy is, moreover, not confined to the uneducated or ignorant by any means, but in several instances which have come under my own personal experience, it has been largely employed by professional men of high standing in the community; and upon its curious antics, many thousands of dollars have been expended in the search for the hidden wealth it was supposed to point out. So complete, moreover, was the faith of these men in this curious instrument, that in spite of the constant failures which attended their efforts, dependent upon the indications of the rod, they still remained firm believers in its value as a test of mineral locations. So important has the using of the divining rod been regarded in some places, that so high an authority on the subject of mining as Dr. R. W. Raymond, has written an exhaustive treatise on the history of the instrument, which appeared some years ago in the Transactions of the American Institute of Mining Engineers

By others, again, prospecting is attempted through the assistance of the clairvoyant's art, if art such methods can be called; and even in this country, educated men, who apparently enjoy unlimited common sense with ordinary affairs of everyday life, have been known to consult such sources of information as to the location of concealed mineral veins upon whose dictum it was proposed to expend large sums in the attempt to find such deposits by the process of shifting; all of which goes to show that the age of superstition has not yet entirely passed away and that there is probably no branch of industry in which so many men take such pleasure in being humbugged as in the ancient business of mining; and none in which men of sound business ability, otherwise, are so credulous or so readily accept the word of a mere adventurer, who may have chanced to pick up a few scientific and technical terms, of which in nine cases out of ten he knows not even the meaning, and upon the strength of whose advice large sums are rashly invested in the purchase and development of properties which are practically worthless. It is a curious fact that when persons of certain temperaments are infected with the mining craze, they proceed to lose very much of their aforetime sound business caution, and there is no doubt that in certain cases this mining fever develops into a form of mild insanity, harmless in general to everyone but the person so infected, but in his case very rarely running its course until every available penny, both of his own property and that of his friends who may be prevailed upon to invest, is most effectually wasted.

While there is apparently no reason why any one should attempt to interfere with the disposition of private funds in the direction of mining investments by anyone who may be predisposed to throw away his personal property in the useless attempt to extract blood from a stone, there are certain conditions from the standpoint of the public and the country's welfare which warrant the presentation of a few facts bearing on the subject. For instance, if the private investor himself were the only one to suffer through the folly, or perchance the knavery, of such representation on the part of an incompetent or dishonest prospector, or so-called mining engineer, the evil would be easily compassed, but unfortunately it has been too often the case that, through the fraud or craft of certain individuals connected with mining matters, or, leaving out the question of fraud itself, through their credulity or ignorance, great harm has resulted, not only compassing the total loss of the private and often limited means of persons who have thereby been reduced to complete poverty, but in some cases has also resulted in great injury to the legitimate mining interests of the country at large.

And first of all, without making any invidious distinctions, it may be remarked that there are prospectors, or so-called mineral experts, who are honest clear through, and who are therefore, in so far as their honesty goes, reliable men and worthy of credence. Whatever mistakes such men may make as to the value of a mining district are, in their case, to be attributed to a lack of knowledge regarding the conditions which govern the occurrence of the mineral sought, in profitable quantity, or to an error in judgment. These are men who very frequently undergo great hardships. They bear, without complaint, the trials and discomfort which attach to exploration in the wild and rugged districts to which their enterprise calls them, and in many of these men the country possesses no braver or more useful citizens. To them, also, it must be conceded that their rewards are, in many cases, but little commensurate with the toil they have to undergo, or with the frequently valuable discoveries which they accomplish. But there are also prospectors of a very different class, as you all know, whose desire, primarily is to make a good thing for themselves or their employers, regardless of the actual merits of the case. There is a class of men; frequently plausible in the extreme, whose statements as to the value of a mineral location it would always be well for the honest investor to confirm before definitely accepting. While there is no doubt that, taking the class of prospectors as a whole, the dishonest men are in a very decided minority, there are certain features of the craft which to the greater part of prospectors are but little understood.

It has already been remarked that there are certain principles which should guide us in the search for the more important economic minerals. Thus we know, by the study of the earth's crust, that certain series of rock strata, all of which have received their proper place in the geological scale, are more likely to contain certain minerals than other formations. For instance, our apatite deposits, in so far as we know them in workable quantities, all over the world, are found only in the rocks which we call Laurentian, and which are the oldest known in the earth's history. Other deposits of phosphate of lime occur, in composition somewhat similar to apatite, in nearly every rock formation from the Laurentian up to the Post-Tertiary, but they are distinct in character from the apatites of the Archean. Again, we look for coal for the most part in the rocks of the Carboniferous system, and we rarely find it in workable quantity in any other series, though we do find it in certain newer rocks, like the Cretaceous, etc., but we do not look for coal mines in the Silurian, any more than we look for apatite in the Carboniferous, because experience teaches us such search would be unprofitable; and so when we read of the discovery of great seams of coal in the Provinces of Ontario and Quebec we are disposed to smile, because the story is an old one and has been often disproved. Thus we might state the probable position of most of our economic minerals, as, for instance, the copper and nickel in the Huronian, the graphite and mica in the Laurentian, the asbestos, gold and silver in the Cambrian, etc.

While to many of our brethren of the mining profession these facts are familiar, and the mode of occurrence of the greater part of the economic minerals is well known, this knowledge from the scientific standpoint is apparently largely a sealed book to others. It would, therefore, seem to be an item of primary importance in the search for mineral lands, that the prospector or pioneer of the industry should possess some small acquaintance with the principles at least by which their explorations might be most profitably conducted and their zeal and energy turned to the best account.

In the report of the Royal Commission on the Mineral Resources of Ontario, lately published, several passages occur having a direct bearing on this aspect of the question, and are worthy of being quoted. Thus, Mr. Coe, one of the Commissioners, says that during "their travels through Ontario, the Commissioners were constantly meeting explorers who did not seem to have any idea in reference to a starting point to their working, but were travelling through the region at random, trusting to chance to make a discovery. Quite a number had spent months unsuccessfully in pursuit of what they would have been able to determine in a very short period had they the necessary knowledge to guide them." And in the remarks on "Technical Instruction" the report also states that "The witnesses examined by the Commission are almost unanimous in the opinion that there is great need of technical instruction in all operations relating to the mining and metallurgical industries of the Province. Few of the men who prospect for minerals have the practical knowledge which would enable them to explore the country intelligently or successfully. Time and money are often wasted in searching for the precious and economic minerals through districts where there are none, and where nature never designed that any should be. Some knowledge of the geology of the country and of rocks and minerals, and their relation to each other, is of obvious advantage to the prospector, and if he is also able to use the blowpipe or make the ordinary tests for metals, his quest cannot fail to be infinitely more satisfactory than it could be without such knowledge, and he may be saved from much disappointment. Some were unable even to make the common and simple test of minerals under the knife, and it is doubtful if one man in ten could make a map or sketch of the district he had examined, so necessary for good prospecting work."

There is another class of men engaged in mineral development, known by the title "practical miners," who exercise a very considerable amount of influence in mining matters, concerning some of whom the peculiar ideas and methods of work deserve at least a passing notice. The practical miner as a rule surpasses the prospector in the variety and the depth of his knowledge. He very frequently assumes to pronounce with much boldness and confidence upon the probabilities of successful work from very superficial and inadequate data, and the opinion of a so-called practical miner is apt to be taken by a certain class of investors as worthy of the utmost credence. Trained as most of them are by actual work in some underground mine, either of gold, copper, coal, or some one of the many economic minerals, some of these men, not all, come to consider that the occurrence of all minerals is governed by the conditions which exist in the particular locations with which they are familiar, It has been doubtless the experience of many of you to know such men—men who glance over the surface of the tract of land which they propose to develop, and who, from some peculiar configuration of the landscape which reminds them of the features of the district with which they are acquainted elsewhere, proceed to argue straightway that like conditions of surface or of soil must lead to similar conditions beneath, and that if successful mining has been carried on in this typical district the conditions here should also warrant a like amount of expenditure. Among them are the men who are frequently found preaching the advisability and desirability of deep shafting on the hypothesis that a shaft is always useful, rather than the adoption of the more modern and scientific method of exploring by boring, when the latter would be equally as valuable at a fiftieth part of the expense. These are the men also who if they find vein matter at the surface straightway consider their fortunes made, in accordance with the general theory that all veins increase in richness and value as they are followed downward—a point by no means established, since, while it may be true of certain veins occasionally, experience has taught us very plainly that the principle is far from being one of general application. Very frequently such practical miners assume the lofty and patronizing tone towards the scientifically trained expert, and, if in charge of important mining developments, tolerate the visits or examinations of such experts as matters of but little importance, and the conclusions arrived at by them after close study as still less so. These are the men also who, frequently promoted from the pit head or the pick to the position of managing engineer, are sometimes responsible for the occasional accidents which at intervals fill our souls with horror as we read the details of the suffering and death caused by the carelessness or the incompetence which should not have been tolerated for one moment after the indication of danger was made known. Not being aware, however, of the source of such dangers, or ignorant often of the means by which they might be forestalled; or through lack of that training which should ever keep one in a place of such fearful responsibility as some of our deep mines entail, on the alert to guard against every danger which can be shunned, matters are perforce too often allowed to go on in their usual happy-go-lucky style till at last the grand crash comes, and the whole land is plunged in sorrow.

To this class also belong the men who shine conspicuously as designers of fanciful sections of rock strata intersected throughout with rich mineral veins, which exist only in the artist's inner consciousness, and who furnish also the statistics of production (estimated), which make so promising a display in a prospectus intended to draw; often, indeed, before the slightest attempt has been made to ascertain anything whatever concerning the actual condition of things beneath the soil or even at the surface. The marvellous stories as to the wonderful wealth about to be uncovered not infrequently succeed in extorting the required amount from the pockets of credulous stockholders, who, in by far the largest number of cases, have to acquire their experience by the payment of good, solid cash, and to whom such experience presents the only form of dividend likely to follow from their investment.

This, however, is only one view of the case. From the celebrated mining schools of London, Frieburg, New York, Montreal and other places, scores of men have been annually graduated for many years in the department of mining engineering, who in addition to the technical qualifications more directly pertaining to the successful development of the mining industries of which they have the control, possess very good knowledge of the various geological and mineralogical conditions which first of all are requisite for the complete understanding of the many puzzling questions constantly being presented as the work proceeds. Among such subjects with which the mining engineer should become familiar, is the question of faults, their direction, disposition and extent; the presence and action of intrusive dykes of various kinds; the frequent change in strata encountered, and the study of the new conditions set up by such change; the character and mode of occurrence of the mineral veins or beds, as the case may be, and the arrangement and age of the rock strata in which the work is being carried on; together with many other problems which have an important bearing upon the successful carrying out of the proposed operations. In countries where a careful geological survey has already determined the conditions favourable or otherwise, for the finding of profitable deposits of minerals, such knowledge may not at first sight appear so requisite to the mining engineer, but very often the mining engineer must, to a certain extent, precede the geologist. Just how such scientific geological knowledge may be applied may seem an undeterminable problem to many, and in illustration we may take some of our mineral deposits in the Province of

Quebec. For instance, we all know that asbestos is found in serpentine rocks. To many the kinds and conditions of these rocks are unknown. The serpentine of one locality appears as likely to be profitable as that from another, and consequently thousands of dollars have been and will be spent in the fruitless search after asbestos on the present evidence of two or three small and straggling veins of no economic importance, with expectations that these are speedily to change their character and become large and profitable deposits. Now, had the mining engineer in charge of these developments fully understood the fact that there is a marked difference in the kind and condition of serpentine rock, depending upon age, origin or other cause; and had he known by careful study of these conditions, what serpentine was likely to yield asbestos in paying quantity, and what serpentine would yield him no asbestos, let him look ever so diligently, much unnecessary labor and capital might be saved. So also in our copper deposits. Those who have read of the great boom thirty years ago, know that hundreds of areas were prospected, placed on the market and sold for fancy prices. Many of these, upon the attempt being made to operate them, were found to be valueless; the copper occurred under such conditions as to render its extraction profitless. Of the many capitalists who invested in copper properties, or mining engineers who attempted to develop these mines, probably not one in fifty ever set himself to study the conditions under which profitable copper lodes existed, or where the chances were so slight that failure was almost certain. Yet we now know that the copper mines of Quebec occur in rocks of different geological horizons, and that the deposits in one part are generally in large amount and of a certain kind of ore, which can frequently be worked at a profit, while, in the rocks of a different formation, where the indications so-called are frequent, the ore is of a different quality, and the quantity such as in most cases not sufficient to pay for the expense of extraction. Thus, for instance, the ore of the one area is a chalco-pyrite, valuable for sulphur; of another, pyrrhotite, in which the greater relative proportion of iron is such as to render it unprofitable, in the present state of the market, for the extraction of copper or sulphur, although the quantity is frequently very considerable; while in yet another case, the ore is exceedingly rich, but the quantity very limited; so that while there appears to the casual observer to be a sufficient amount to warrant development, experience, often bitter, has shown that such expectations have been so rarely realized that the whole may be considered failures. Precisely the same mistakes are made in connection with the coal deposits in the Lower Provinces. Thus, while there are beds of enormous thickness at Pictou, Springhill, and Sydney, which are almost practically inexhaustible, these are confined to a certain portion of the middle carboniferous formation known as the productive coal measures. Other seams, however, occur in a lower part of the formation, known as the millstone grit, and even in the lower carboniferous formation, and attempts have been made to work certain of these, generally without success, except very locally, and under certain peculiar conditions. Now the rocks of the productive measures and of the millstone grit, while possessing certain features in common, such as the occurrence of shales and sandstone of various colors, are yet, to the trained geologist, distinguishable, and no one who understood the true conditions of such a case would advise the payment of large sums of money in the acquisition of a so-called coal area, on the presence of a thin seam of coal only, when the rock could be recognized as of millstone grit age. Yet how often is this attempted, and how often is this attempted, and how many persons have had to deplore the lack of proper geological knowledge on the part of themselves, or of the mining engineer employed, through whose advice a sum of money vastly disproportioned to the value of the property in question was, to it plainly, squandered; and so instances might be multiplied. There are certain conditions, favorable or otherwise, in many supposed mineral localities, which become clear when studied under the light of experience. Yet, strange, to say, in very many cases the advice of the geologist when asked in regard to the prospects of a certain location, should it chance to be unfavorable and not in accordance with the wishes of the owner, is confidently disregarded with the remark that scientific theories are of no value anyway as regards successful practical workings. I imagine there are not many of us who cannot recall some instance of the foolish and useless expenditure of money in the vain search for mineral wealth in opposition to the expressed opinion of the well-trained geologist. Very often the declared opinion of the practical miner, who confidently knows all the conditions, is preferred, though the consequences of following such advice, in many cases, are disastrous in the extreme.

It is a lamentable fact that of the many highly trained graduates in mining engineering who pass out annually from such celebrated schools as McGill possesses, scarcely one finds employment in connection with the mineral development of our own country. If this total lack of appreciation of the value of scientific training on the part of our mining engineers by our mine owners and capitalists could be attributed to the absence of mineral deposits in Canada of value sufficient to be opened or operated properly, it might be deplored. On the contrary there is probably no country in the world where the supplies of mineral wealth, in nearly every form, are more abundant than in our own Dominion. Such negligence of our trained mining engineers cannot, moreover, be due to a lack of ability or qualifications on their part; for we find that when they seek their fortunes on the other side of the boundary they very speedily fill exceedingly important and lucrative positions in charge of mining works. If we look at our mining centres and examine the qualifications of those in charge of even our most important mines, we can but be forcibly impressed with the fact that by far the greatest number of those in charge are lamentably wanting in even the rudiments of scientific training. Would it be too much to say that, in all probability, the present unsatisfactory condition of our mining industries in Canada to-day is due to the fact that, possibly in order to save the payment of a decent salary to a man qualified to undertake the successful development of a mine, some one ignorant of what is requisite to success, is placed in charge. Not only is the managing engineer, so-called, often deficient in the technical qualifications requisite to properly open and work the property over which he has control, but very frequently he possesses no mining qualifications whatever, and has not even the smallest idea of what should be done. While in every other business in life it is thought desirable to place the management in the hands of men who understand best how its affairs should be conducted, with an eye to profitably carrying on the industry, in mining only does the principle seem to apply that no special qualifications are necessary, save that of drawing one's salary monthly. It is certainly not saying too much if we suggest that were our mining industries as a whole placed under the control of men who were educated, not only in the technical branches of their profession, but in the other scientific departments as well—as, for instance, the principles of geology and of mineralogy,—the status of

Canada as a mineral producing country would be increased tenfold, and to add that, with proper legislation, many industries now apparently dead would be flourishing. Why, for instance, should our iron beds remain idle? Oh! people will say, there is no fuel. Yet here we have at our door, limitless quantities of splendid peat which, at a cost not exceeding one dollar per ton, according to Mr. D. Aikman, can be manufactured into a compressed fuel equal, for many purposes of iron manufacture, to any imported bituminous coal, while for the puddling and refining process we have, in the basin of the St. Lawrence, natural gas as yet practically untested, although from the efforts made in this direction sufficient has been ascertained to warrant the expenditure of a certain amount of money in its search. The importance of this fuel peat, not only for domestic use, but for various processes of manufacture, including that of iron, has been already pointed out by Dr. T. Sterry Hunt, in various reports to the Geological Survey. But if we have not in Ontario and Quebec the necessary fuel in the shape of raw coal directly to hand, certainly, if it is profitable to the iron smelters of the United States to carry raw ores from western Lake Superior and Canada for their furnaces, it should be equally as profitable on this side, and even more so, in the face of the duties imposed on raw material, to import a certain amount of raw coal or coke for smelting purposes in our own country, while from the enormous forests of hardwood which everywhere cover our Laurentian hills and our other mountain ranges, an unlimited supply of the best charcoal can be obtained at a very low rate. Under such conditions, and in consideration of the protection afforded the industry by the Federal Government, it does appear only reasonable that the smelting of our iron ores, which occur in such enormous quantities, should receive far more consideration than has yet been bestowed upon this important element of our national advancement.

That our gold fields are rich beyond those of most countries may not be generally known, but that there is an abundance of gold in certain portions of the eastern counties of Quebec, sufficient, if properly worked and under proper scientific methods, to pay handsome dividends, either by washing the gravel, or by the process of crushing the quartz up, is a fact that cannot, in the face of the evidence before us, be disputed. This industry, however, has never, in so far as can be ascertained, been prosecuted with any regard to an intelligent conception of the conditions existing or the proper methods to be employed.

If the members of the General Mining Association of Quebec should do nothing more than arouse an interest in the proper and scientific development of our mineral resources, it would prove itself worthy of the thanks of the whole Dominion. The land teems with mineral wealth, from the Atlantic to the Pacific. Of several of the most important minerals we have at present practically complete centrol, viz': of our asbestos and nickel, and yet of the former it must be said, so bad has been the system of development and extraction that the greater part of the mines are now in a positively unsafe condition as regards working. Had there been the proper amount of scientific and technical training on the part of those in charge at the outset, much unnecessary future delay and expense would have been avoided. A society such as this should be able to exercise a very marked influence in different ways; not only in keeping a watchful eye upon legislation which may prove injurious to the general welfare of the mining centres individually, but to the mining interests as a whole, and in having a watchful care over the interests of the men employed—the conditions of whom, for good or ill, depend, in most cases, upon the intelligence and the amount of scientific knowledge possessed by the persons in charge, among whose first interests should be the keeping of the mines themselves, in which these men have to labor, in such a condition of safety that life and limb may not be needlessly imperilled, and in providing for the sanitary condition of these mining centres as well. Some legislation tending in the direction of a proper system of mine inspection by thoroughly competent men, would be of the greatest value at the present time, and would tend to do away with much of the loose methods of work and of the carelessness, the consequences of which we hear from different portions of the mining centres. The formation of local mining clubs also, where items of interest in connection with the different branches of the industry might be discussed, and in the establishment of night schools for the men, and questions of sanitation, etc., are also important ones. These clubs could formulate their ideas in a series of papers to be presented at the regular meetings of the society, and thus a healthy and beneficial interchange of thought and sentiment among all the departments of mining work could be promoted with much profit to all interested.

Sir William Dawson—Before I leave to fill another engagement, I desire to thank you for the privilege of attending this meeting. If any of the members would like to visit our Peter Redpath Museum, I shall be glad to show them round, and do anything for them in my power.

The President expressed his pleasure at the presence of the venerable Principal of McGill at the meeting, and having returned thanks on behalf of the members present, for the kind invitation to visit the University, announced that in consequence of the non-arrival of his apparatus from New York, Prof. B. J. Harrington would be unable to read his promised paper on "Assaying by Electrolytic methods."

Prof. Harrington—Messrs. Eimer & Amend, New York, from whom I purchased the apparatus, faithfully promised to have it sent on for this meeting, but as they have not done so, I must ask you to postpone the subject until another meeting.

OCCURRENCE OF ASBESTOS AT TEMPLETON, QUE.

By F. Cirkel, M.E., Templeton, Que.

Of all the minerals which have been discovered and worked in Canada, none of them have assumed so much economic importance in such a short time as asbestos. The growth of this industry since the discovery of this mineral in the years '77 and '78 in the hills of Thetford, and Coleraine, is seen in the fact that in the first year of mining operations, in '78, there were taken out only 50 tons, and in the year '90 about 6,000 tons in that district. But not only here; in many other localities, principally in the west of the Province of Quebec, asbestos has been found to occur, and even sometimes worked. Thus asbestos has been discovered in the Papineau, near St. André, in the Ottawa Valley; Gatineau, Township of Wakefield; and in many places of the Township of Templeton. But in these places, since the discovery of the mineral, no growth of the industry is to be stated like in the Eastern Townships —no work on a large scale has been established yet. From the Templeton district, it is reported that in the year '89 some tons of asbestos were taken out in the Range 8, Lots 10 and 11, and the opinion prevailed amongst geologists—according to the Mineral Resources of Canada, '85—that the mining of asbestos in this section of the country was destined to become an industry of some importance. Sufficient studies of the occurrence of the asbestos bearing rock, however, had not been made; the deposits were not accessible, and therefore it was difficult to form an opinion about their extent. Since April, last year, in the said Range 8, Lot 11, some development work has been done with a view to studying those peculiar rocks, and it is the purpose of this paper—so far as investigations have shown—to describe the mode of occurrence in this latter place.

The rock in which the asbestos occurs forms a large strata of massive crystalline limestone of about 700 feet in width, striking in a north-east and south-west direction, confined on both sides to red, grey and white orthoclase gneiss in great variety. Quite pure limestone is seldom met with; for the most part it contains impurities of small crystals of mica, iron pyrites, small veins of graphite and sometimes pockets of hematite in small extent; grains of serpentine are disseminated through the whole massive rock, and serpentine deposits as asbestos bearing rock in their peculiar and strange forms are very numerous. The latter form disconnected lumps, patches or pockets, of small extent, from 1 foot up to 3 feet in diameter; irregular masses of limited extent, and round layers with ring or elliptical sections in a diameter of 3 to 50 feet, and with serpentine walls varying from ½ foot up to 3 feet in thickness. The character of this deposit on the surface is for the most part a circle or an ellipse, though in different places straight veins of small extent have been observed. It is remarkable that the round veins are mostly sharp, limited to the inside, while to the outside almost a gradual change in color from serpentine to limestone is to be seen. These deposits are, in relation to the limestone masses, very numerous; nearly all of them contain asbestos more or less; deposits of small extent bear few laces—seldom asbestos veins of considerable length. Concerning the colours, they are very various; light green, yellow green, dark green, greyish-green; and it is difficult to say which color is characteristic for the occurrence of asbestos. Greyish-green colour is seen very often in deposits of considerable extent, mostly containing small laces of asbestos. Small cracks caused by the mechanical action of water are very numerous, and, therefore, the material splits up very easily and is hard to get in large pieces. On account of this fault, it cannot be used for ornamental purposes. Fresh serpentine contains much water and is easily separable from the asbestos. Some light green varieties are soft and have a peculiar unctuous aspect.

The occurrence of asbestos in these deposits is highly irregular. Laces of ⅛ of an inch increase to veins of 1½ inch in thickness, which continue for a short time and then split up again. Other conspicuous veins of ⅝ to ½ inch in thickness split up in many minute laces of $\frac{1}{20}$ of an inch, come together and form a large vein. These veins are seen sometimes to be displaced out of their natural position, cut off by cracks running, as observed in two places, perpendicular to the strata line; a displacement, however, larger than two feet has not yet been observed. The general direction of all veins is mostly parallel to the limited flats.

In many cases instead of fibrous veins, asbestiform matter of white colour and of the same structure is met with; it has an unctuous aspect and shows occasionally the gradual change to the fibrous variety. Concerning the asbestos itself, the highly silky fibre is adapted very well for spinning; it has a marked wavy lustre, a light yellow, light green or dark green colour, is very transparent as a sign for the absence of impurities. Several chemical analyses have shown that the Templeton asbestos contains very little iron, much less than any other asbestos in Canada. Black-blue varieties, with very nice silky fibre of 1½ to 2 inches, has been observed in only one place in a depth of 60 feet; this occurrence, however, seems to be accidental, supposing that the depth scarcely may have an influence either on the color or on the largeness of the fibre.

Concerning the quantity of these asbestos-serpentine deposits, they are distributed through the whole limestone strata, and on account of the lack of leading indications it is difficult to say which part of limestone probably can contain a large number of deposits, even when very good surface veins are seen. In one place there were seen on the surface, five round veins 5 to 12 feet diameter, close together, and with very nice asbestos laces of ¼ of an inch up to 1¼ inches, and the opinion prevailed that this place in depth might contain a large quantity of asbestos, or a large number of other asbestos-bearing deposits. Quarry work was started, and besides the above-mentioned deposits, six smaller ones of 3 to 5 feet diameter, in a depth of 40 feet, had been found; four of them did not contain any asbestos, and the other two had small veins. The results of this trial work were unfavorable, in so far as the ratio of the cleaned asbestos to the raised rock was very small. Amongst many other deposits which have been found, there are two remarkable. A large vein, with ellipse surface character, of about 50 feet in larger diameter, with serpentine walls of 2½ to 3 feet, and splendid fibre of ½ to 1½ inches on the surface, showed in a depth of 60 feet the same quality, the same length of fibre and width of the serpentine. In the same depth this vein was followed by a drift, and it was stated that it had no larger extent in the horizontal section, the serpentine walls being vertical and regular in occurrence. Close to this vein a great number of serpentine lumps were seen, but the asbestos occurred in the same in few small laces.

Another vein, with ellipse surface character, 40 feet larger diameter, with very nice silky fibre on the surface, had, in a depth of 45 feet, the same width of serpentine and the same length of splendid fibre as observed on the surface.

Most of all the other asbestos-bearing deposits found on the surface or under earth did not show a larger extent than 20 feet. It was often observed that in these deposits asbestos of considerable length occurred on the surface and disappeared by following the vein into the depth. This fact shows evidently that one cannot always rely upon good surface indications in deposits of smaller extent; it shows that it is impossible to make any calculation about the quantity before the vein is opened in different places.

It seems, however, that generally deposits of larger extent, with good fibre on the surface, continue, as observed in two large layers, into the depth, and that these deposits do not show such large irregularities in the occurrence of serpentine and asbestos as such of smaller extent. This observation, and the fact that serpentine layers of considerable extent are found to occur in other limestone strata of the Township of Templeton, gives us some reason to suppose that extensive profitable mining work can be done, if it is possible to find a certain number of large deposits, and there is all probability that the latter can be found.

The origin of those peculiar serpentine layers, is an unsolved problem yet. But when we take into consideration the discovery of *Eozoon Canadense* by Dawson, the careful observations by Gumbel, Hochstetter and Credner, about pre-existence of organic life in the rudimentary crystalline limestone, we have some reason to suppose that these peculiar forms are built up by organic forms—probably by foraminiferes—and that after the death of the animals the cells have been precipitated by silicates of magnesia out of the water of the ocean. Probably the fissures have been caused by shrinking of the serpentine, and then filled with asbestiform matter by the activity of water. But this theory must be proved yet by microscopical investigations and it is not the purpose of this paper to enter into discussion about this subject.

Mr. W. H. Lynch, Danville, concluded the session by a few well directed remarks on the subject of the development and wonderful promise of the Kootenai mineral district, British Columbia.

SECOND ANNUAL DINNER.

Promptly at eight o'clock, the members of the Association and their guests filed into the Ladies' Ordinary at the Windsor Hotel, and sat down to an excellent dinner with an appetite all the more keen from a hard day's work. The tables were tastefully decorated. McQuirk's orchestra supplied the music. Hon. George Irvine, Q.C., presided, having on his right, Mayor McShane, and on his left Mr. H. S. Poole, General Manager, Acadia Coal Co., Stellarton, N.S. Capt. R. C. Adams occupied the vice-chair, having on his right Prof. B. J. Harrington, and on his left Prof. H. T. Bovey of the faculties of Applied Science and Civil Engineering of McGill University. Among the other guests present were: Prof. McLeod, Secretary, Canadian Society of Civil Engineers, Montreal; Mr. H. S. Budden, Managing Director, Intercolonial Coal Co., Montreal; Dr. Robt. Ells and E. D. Ingall, M.E., Ottawa; W. H. Lynch, Danville, Que.; E. Arnoldi, J. Maclaren, J. T. Donald, M.A., etc. Letters of apology were read from the following: Sir William Dawson, Hon. H. Mercier, Rev. Abbé Laflamme, A Blue, Director of Mines, Toronto; Dr. Selwyn, Ottawa; Hon. E. Dewdney, Ottawa; E. Gilpin, F.G.S., Halifax; T. R. Gue, Halifax; John E. Hardman, S.B., Oldham, N.S.; Dr. Geo. Dawson, Ottawa and others.

The usual loyal and patriotic toasts having been honoured, Dr. R. W. Ells proposed the "Mining Industries of the Province of Quebec," commenting on the remarkable growth of the mining industries of the Province in recent years, and on the system of working in vogue at the mines.

HON. GEORGE IRVINE, Q.C.—I am asked to respond to this toast in a sort of a representative capacity as President of this Association. As you well know I am very deeply interested in mining, and I may for that reason say that it is with great sympathy that I respond to its interest. I could not help thinking to-day when I heard our excellent friend Capt. Adams, explaining mining luck, when he told us that ninety-five per cent. of the money put into mines was lost, that there were a good many people belonging to this Association that belonged to the five per cent. who were successful. Gentlemen, I fully appreciate all that has been said by Dr. Ells just now, and by the other gentlemen I have heard to-day, about the importance of a good technical education. Now, gentlemen, any person will see the importance and advantage of that. At the same time I must say, on behalf of men who are not technical men, that I have been interested in mines respecting which technical men have not given good advice. For instance: A friend of mine, who was then living in Quebec—a very energetic engineer—came to me one day and said: "You are a friend of mine and I would like to give you some advice—you are not working that mine of yours right—I will show you how to do it and you will make very much more money." I said "It is very kind of you." Well, there happened to be also in Quebec at that time a man who was acknowledged to be one of the most eminent mining engineers in the Province of Quebec, and I told him what the man had said. He examined the mine very carefully and he came back to Quebec and said, "You have been working that mine for five or six years at a profit?" I said "Yes." He replied: "Go on as you have done; you have done very well." (Laughter.) That was on the technical, but we have gone on on the practical advice since and we have had a very fair share of success. I simply mean to say by this that with luck it is quite possible to go on as we have done. Gentlemen, I thank you for the appreciation you have shown to mining interests in which you are all concerned yourselves.

Mr. S. P. Franchot and Mr. D. A. Brown also responded.

Mayor McShane—With your kind permission I beg to propose a toast, and again with your permission I beg to tell you a little story. There are no ladies present. (Oh!) It is not a naughty story. (Oh!) It is simply this, gentlemen: A few years ago I was at a school examination and the class was examined by the different professors and the last question put to the boys was this: "Who was Moses?" All the little boys snapped their fingers, and one little fellow by the name of Jack McLynn said "I know it, I know it!" and the professor said, "Well, who was Moses?" Jack McLynn said, "He was Pharoah's eldest daughter's son." The professor said, "Not at all, Moses was found in a basket in the bulrushes." The boy said, "Oh, no! *that was what she said.* (Laughter.)

Before I propose the toast, I desire to say that as Mayor of the City of Montreal, I am proud of the gentlemen who are mixed up in the mining interests of this country. My friend Captain Adams is a gentleman whom I have known for a long time, and I notice that he has taken a great part, and has given himself a great deal of trouble to develop the mining interests of this country. I had the pleasure the other day with a number of aldermen to visit that grand institution, the Workman Engineering building, which is about to be built up by Montreal gentlemen, whose energy is doing and has done so much for our city. I visited that great building which is soon to be completed, and which will be an institution that nothing will compare with on this side or the other side of the Atlantic. I ask you to drink to the toast, and I have the honor to name your president—a gentleman who for many years has occupied in this great Dominion of ours the highest position the people can confer upon him—a gentleman whose whole life and associations are with the people; there is not a man living who is more respected by the people than my friend, your president, Mr. Irvine—his talents, his great ability as a lawyer and as a judge have won for him the highest esteem in Admiralty circles, his success as a miner, and his principles of fair play have won for him the respect of all the people of this great Province of Quebec; therefore, gentlemen, I am proud to stand up, as the Mayor of the people—of the citizens—your mayor, and in the name of the people of Montreal I desire you to drink to the health of your president, my friend, Mr. Irvine. (Loud applause.)

The toast was drunk with "three times three" and all honors, "He's a jolly good fellow," &c.

Hon. George Irvine—You have received the toast Mayor Mc Shane has proposed with a great deal more enthusiasm than I have deserved. Mr. McShane has spoken flatteringly of me, but you know he is an Irishman, and sometimes given to blarney (laughter); at any rate Mr. McShane and I have fought in old times, we have fought side by side; sometimes we agreed and sometimes we have disagreed—most times we have agreed, though. He and I fought together to try and put down a great evil in this country, which is corruption in high places; no man can say that the people's Jimmy has ever changed, he will continue to do as he has always done. Gentlemen, I thank you very much for the way you have so kindly treated me. I have done the best I could do for the Association, and if I have done any good I am pleased to have done it, and I thank you very much for the kind way you have drunk to my health.

Capt. Adams—I am glad to propose a toast to our schools of Mining and Technical Education, not that I feel qualified to do justice to the subject, but because I am an enthusiast in mining, and being a Boston man must necessarily be a friend of education. Our worthy Mayor has told you about the birth of Moses, and as we need all the endorsements that we can get for our industry, it may encourage you to know that Moses was the first miner. Mining men are usually religious, and you are doubtless all familiar with the good old hymn, "Could I but stand where Moses stood and view the prospect o'er," showing that our honorable pursuit is of great antiquity, and that Moses was successful in his finds, for he not only went prospecting, but actually saw the ore. Mining in Canada has too often been done by main strength and stupidness, and I prided myself upon being the first person in the phosphate industry to employ a skilled mining engineer. He made a systematic search for minerals, and built elaborate shafts, but the veins never came together where his science demonstrated they ought to, and at length his shots blew out the underpinning of his well constructed crib work. (Laughter.) I found that an educated engineer might be like some mines; he shows well on the surface but there's nothing in his lower levels. Education means to lead forth, and there must be something in a man to be brought out. Another experiment was more fortunate. I engaged a young doctor of philosophy from Harvard College, who was at first badly snubbed by my "practical" manager, who said: "I have seen enough of such fellows, and I don't want any more of them about me." He however eventually became manager of the mine, and is now assistant geologist of the State of Arkansas. (Applause.)

The origin of the name of "Canada" is thus given: The Spaniards visited Canada previous to the French, and finding no gold or silver, which they were in search of, often said among themselves, "Acanada,"—there is nothing here. The French arrived, and the Indians, who did not want their company, and supposed they were also Spaniards on the same mission, were anxious to inform them in the Spanish sentence "Acanada." The French, who knew as little Spanish as the Indians, supposed this incessantly recurring sound was the name of the country, and gave it the name of "Canada." But even if this story is true, its implication is not correct. There is a good deal in Canada, and it will be better utilized when more knowledge is applied to its development. It is said that north of Lake Superior every man owns a mine; poor men have two or three mines, and very poor men have seven or eight mines —the poorer they are the more they have. (Laughter.) Men are impoverished by their riches. We need education to enable us to work these properties economically, to surmount natural difficulties, and to throw off legal shackles. In phosphate we need mechanical or chemical processes for the separation of the ore from impurities; in asbestos we need better systems of cleaning the fibre; in gold we want improved processes to amalgamate the arsenical ores of Madoc, of which forty per cent. are said to be wasted, and it is technical education that will lead to these discoveries.

The phosphate men especially, should favor these schools, for is it not said by a German philosopher, "Without phosphorus no thought," and I have come across a parody of an old nursery rhyme:—

"Sing a song of phosphates,
Fibrine in lime,
Four and twenty follicles
In a vein of time,
When the phosphorence
Evoluted brain,
Superstition ended,
Man began to reign."

The asbestos men may pride themselves on the antiquity of the use of their marvellous product, if it be true, as is stated, that the three worthies who survived the scorchings of Nebuchadnezzar's fiery furnace were clothed in asbestos suits. Asbestos miners are largely dependent upon the application of educated intelligence not only in the production of their mineral, but in discoveries of methods of using it.

We are glad to learn that our honored president has "made his pile" in mining, and that our worthy Emerald friend "The Duke of Buckingham," has a bursting pocket book, but if we are not all rich we all expect to be rich, and there is not a miner present who is not on the eve of a great "strike," and who is not sure of being a millionaire in a few years; for as Pope says, or meant to say, "Hope springs eternal in the miner's breast." (Applause.) I wish therefore to let my remarks lead to a practical conclusion. It is very easy for us to give away what we haven't got, and I wish to propose that we should to-night agree that a goodly proportion of the large mining profits that we are all going to make shall be presented to McGill College to endow the branches of mining and chemistry and its science courses so that it shall become the very best school of mining upon this continent. Mr. Chairman, I have much pleasure in proposing the toast of "Our Schools of Technical Education." (Loud applause.)

MR. W. C. CARLYLE, Lecturer on Mining Engineering at McGill University, in returning thanks, gave some incidents in his mining career in Colorado to illustrate the utility of having a good technical education when combined with a sound practical experience in the actual mining work. He was loath to think that our mining laws were not as they should be, and he was astonished to find that in the Province of Quebec the miner to-day was in doubt as to the security of his title to lands of which he has had possession for many years. He believed that mining property should be for the people and not for the Crown. Every facility should be given to the prospector, the capitalist, and the miner, to engage in mining ventures.

Prof. Bovey and Prof. Harrington also acknowledged the toast on behalf of their respective faculties.

Mr. H. A. Budden proposed, in a few well-chosen sentences, "The Mining Industries of Canada."

Messrs. H. S. Poole replied briefly for Nova Scotia, and W. H. Lynch at some length for British Columbia.

Prof. McQuirk having favored the company with a song, Mr. B. T. A. Bell proposed the toast of kindred societies, to which Prof. Macleod replied for the Canadian Society of Civil Engineers, and Mr. E. D. Ingall for the Logan Club.

Mr. L. A. Klein also acknowledged the toast on behalf of the Asbestos Club. He took some of the speakers at the afternoon session to task for the slur that had been cast on the methods of working the asbestos mines. He claimed that all the mining engineers of the world, and the staff of the Geological Survey combined, could not have opened their quarries in a more systematic or skilful manner than they had been, and he pointed out in support of his contention that there had never been an accident of any consequence except, in the case of "a man who had been blown up by lightning." (Laughter.)

The other toasts were, "Mr. B. T. A. Bell, our Secretary," proposed by Capt. Adams; and "The Geological Survey of Canada," proposed by Mr. W. A. Allan. During the evening an excellent musical programme was gone through, the principal contributors to which were Messrs. E. Arnoldi, W. H. Irwin, Prof. McQuirk and Wm. Sclater. The proceedings terminated at midnight.

QUEBEC MINING ACT.

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INTERVIEW WITH THE COMMISSIONER OF CROWN LANDS.

—

QUEBEC, 31st MARCH, 1892.

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On Thursday, 31st March, the following deputation, representing the Association, had the honour of an interview with the Commissioner of Crown Lands at Quebec, with reference to the mining law of the Province :—

Hon. George Irvine, Q.C., *President* (Johnson's Co'y),	Quebec,
James King, M.P.P., *Vice-President* (King Bros.),	Quebec,
L. A. Klein (American Asbestos Company),	Black Lake,
John J. Penhale (United Asbestos Co.),	Black Lake,
Capt. Matthew Penhale (Glasgow & Montreal Asbestos Co.),	Black Lake,
Col. Lucke (Beaver Asbestos Co.),	Sherbrooke,
A. M. Evans, M.E. (King Bros.),	Black Lake,
O. M. Harris (Canadian Phosphate Co.),	Montreal,
J. Lainson Wills, F.C.S. (Generl Phosphate Corporation),	Ottawa,
J. B. Peters (Peters' Asbestos Mine),	Quebec,
J. Burley Smith, M.E. (Anglo-Continental Guano Works Co.),	Glen Almond,
R. T. Hopper (Anglo-Canadian Asbestos Co.),	Montreal,
W. H. Jeffrey (Jeffrey Asbestos Mine),	Richmond,
B. T. A. Bell, Secretary (Editor *Canadian Mining Review*),	Ottawa.

The deputation was received by the Hon. Mr. Flynn, Commissioner of Crown Lands, and the Hon. Mr. Pelletier, Attorney-General.

HON. GEORGE IRVINE, Q.C., having explained the object of the interview, stated that he believed the Government had repealed the confiscatory clauses of the Mercier Act. Is that so?

HON. E. J. FLYNN—Yes, I believe so.

HON. MR. IRVINE, resuming, dwelt upon the extent and importance of the mineral industry and the benefits to be derived by the Province from its fullest growth and prosperity. That portion of the country on the line of the Quebec Central Railway, where his mines were situated, was until the establishment of the asbestos industry, a barren and uninhabitable wilderness, but with the opening of the asbestos mines there had grown up large settlements and a prosperous community. Mining was certainly an industry worthy of being encouraged by the most liberal legislation. Two years ago the Dominion Government, with a view to its extension throughout the country, had admitted free of duty all machinery of a kind or class not already manufactured in the country. This has proved a great benefit to the producer, inasmuch as it permitted him to import certain classes of machinery, indispensable to his work, not to be had in Canada. The Mercier Act was probably not intended to be unjust, as some of its provisions assuredly were. It was framed and passed without obtaining the views of the persons engaged in mining, who were the only competent parties to be consulted, or who could give information on a matter of so vital importance to them. The Bill was passed through the House, he thought, in one day's sitting—certainly in two—and the following day was printed. The miners were given no time to object or suggest amendments. The royalty on the gross product, which he was glad to hear had been repealed—at all events on mining lands sold by the Crown prior to 1880—was most unjust. Many of the companies made very large expenditures in labor and machinery, and the returns often were small, in some cases none at all. This royalty, if carried out, would have diminished or annulled these small profits, while the loss of the companies not making any profits would be greater. The mining community, he thought, contributed already by their corporation taxes, imposts on powder magazines, municipally and otherwise, more than their fair share of the public revenue. They certainly did not object to contribute their fair share of taxation, but it must be just and equitable. Royalty on the output of mines was a pernicious system that was generally condemned by miners all the world over. He was sure the Government would gain more—at all events the producer would—by the total abolition of any royalties on the product of the mines. It would be better to sell the mineral properties of the Crown at a good price outright. The old practice of placing them up at public auction had worked acceptably. He pointed out that the Mercier Act gave extraordinary powers to inspectors, such as determining boundaries, which he claimed should be settled by the courts by action *en bornage*. One good inspector was quite sufficient. The men appointed were people who knew nothing about mining; in the Thetford district the official was a lawyer, a very respectable gentleman, no doubt, but not in any way qualified to deal with mining questions from a practical or theoretical standpoint; in the County of Ottawa, the inspector, Mr. Viau, he understood was a shoemaker. There was also a good deal of complaint about the infringement of the law respecting the sale of liquor in mining districts. The men could buy the liquor by the bottle from stores, and a good deal of trouble and annoyance had been created. The inspector might be given powers to deal with such cases. Mr. Irvine then made a strong case against the tax on powder magazines. The amount, $150, for a minimum storage of 25 lbs. of powder or explosives of any kind was felt to be excessive and uncalled for. The amount should be minimized. He called attention to the serious menace mining companies had in the case of bush fires. Much loss had been inflicted by the careless and wanton destruction of valuable timber by settlers clearing their bush land. He asked for a more stringent application of the law in this regard.

MR. JAS. KING, M.P.P.—I do not think I can add anything to what Mr. Irvine has said. I take it as the policy of the Government to do everything in their power that will tend to develop the industries of this Province, and to do so means to draw capital and capitalists. You must do something to bid for this capital; you can not do better in the interests of this Province than to bid for the capital to develop its mines and minerals. He commended the Act of 1880, the main features of which were fair and equitable to the investor and producer.

MR. PELLETIER—I think the Province of Ontario has charged a royalty.

MR. B. T. A. BELL—Yes; but Ontario lands are to be granted on the lease system, and royalty is not to be collected for some years after the entry has been made. At all events the law is not retroactive like Mr. Mercier's. The imposition of the tax under the Mercier Act of 1891, had created a feeling of insecurity, and capitalists were chary of investing until some assurance had been given that it would be annulled. Every inducement should be given for the investment of capital, and the fewer restrictions the better.

MR. J. BURLEY SMITH said he never, in all his experience, heard of an inspector collecting taxes. Their duties ordinarily were largely to see that the laws concerning the health of the employees were observed.

His company had a good deal of money invested in works at his mine. Last fall the farmers set fire to their bush land and started a conflagration which was within an ace of completely destroying the buildings. The Government should not only make laws to take money from the miner, but should also legislate to protect and promote their interests. He would suggest that some power be given to the mine inspector to enforce the law already in existence with regard to these bush fires. He should have power to compel the Forest Ranger to carry out the laws. This official had never been at his place, and had paid no attention to his letters, calling attention to the wilful destruction of the forest and the danger caused to his buildings thereby.

Hon. Mr. Irvine asked that any new legislation might be submitted to the Association for suggestion.

Hon. E. J. Flynn—I am much pleased to meet this delegation and to hear the opinions thus expressed on a question which I have given much thought and study. While, of course, I cannot voice the views of the Government, or say what it will do, I may say that, personally, I do not think the mining industries have advanced to that stage when they can be made a source of revenue. Some years ago, when framing the Act of 1880, I went very carefully into the matter, and I did not think we could adopt a revenue policy then. I have seen no reason to change that opinion. I am in favor of as liberal a measure as possible to protect both the interests of the mining industry and the revenue of the country. When all is reckoned, very little revenue has been derived from this source in the past. The law I intend to introduce must of course have the concurrence of my colleagues. I will be very pleased to have suggestions from your Association. I am in favor of a measure which will give satisfaction to all.

Hon. Mr. Irvine having thanked the Commissioner and Mr. Pelletier for their very courteous hearing, the deputation withdrew, well pleased with the result of their interview.

QUARTERLY MEETING.

BLACK LAKE, QUE.

TUESDAY, 14TH JUNE, 1892.

On Tuesday, 14th June, about fifty members visited the asbestos mines at Thetford and Black Lake, Que. Among those present were:

Capt. R. C. Adams, Montreal.
J. Lainson Wills, F.C.S., Ottawa.
A. W. Stevenson, C.A., Montreal.
F. Cirkel, M.E., Templeton.
W. E. Bell, Toronto.
J. Burley Smith, M.E., Glen Almond.
R. T. Hopper, Montreal.
A. M. Evans, Black Lake.
Col. Lucke, Sherbrooke.
J. S. Mitchell, Sherbrooke.
John J. Penhale, Black Lake.
Capt. Matthew Penhale, Black Lake.
D. A. Brown, Boston.
Mr. Erbhardt, New York.
George R. Smith, Thetford.
William King, Thetford.
L. A. Klein, M.E., Black Lake.
B. T. Kirkhouse, Montreal.
F. A. Halsey, Sherbrooke.
B. T. A. Bell, Ottawa.

EXCURSION TO THE ASBESTOS MINES.

Immediately on arrival of the morning train from Sherbrooke, to which, by courtesy of the management of the Quebec Central Railway, a special car had been reserved for visiting members, the party was escorted by the local committee to the various mines and works at Thetford, visiting in turn those of the Beaver Asbestos Co. (Ltd.) the Johnson's Co. (Ltd.), King Bros., and the Bell's Asbestos Co. (Ltd.) After some time had been pleasantly and instructively spent in this way an excellent luncheon was served in one of the large warehouses of the Bell's Asbestos Company which had been specially fitted up and was tastefully and profusely decorated for the occasion. Mr. D. A. Brown, who presided, heartily welcomed the Association to the district, to which Capt. Adams appropriately replied. Luncheon over the members divided into parties and spent some further time in inspecting the works in the district. Mr. Wm. King also hospitably received the members in his house and further refreshment was served here before departing by train for Black Lake. On arrival at Black Lake a number of teams were in waiting and the members were driven to the asbestos properties of the American, United, Glasgow and Montreal and other companies operating in the district.

MEETING IN THE ASBESTOS CLUB.

At half-past five o'clock the members assembled in the rooms of the Asbestos Club for the transaction of business. In the unavoidable absence of the President, Capt. Adams occupied the chair. The minutes and reports of Council having been submitted and confirmed, the Secretary read the following correspondence:—

PROPOSED MINING CONVENTION AT MONTREAL.

Mr. B. T. A. Bell, NEW YORK CITY, June 4, 1892.

Ottawa, Canada.

DEAR SIR,—The Council of the Institute has voted that the annual meeting, beginning February 21, 1893, be held in Montreal, provided of course, that our Canada friends find it practicable to carry out their proposed arrangements, and that they confirm the preliminary invitation sent by way of inquiry.

This decision has not been publicly announced, and you need feel no embarrassment in nodifying me of any change in the situation rendering the withdrawal of the invitation desirable, or rather, of any change, which, if you had known of it before, would have led you to postpone your plan.

If, however, you should be able to advise me before June 28, that your arrangements had been successfully completed, so that the meeting could be announced with reasonable certainty, it might be pleasant to speak of it at the Plattsburg meeting. I shall probably not be at this office later than June 24. After the 23rd, therefore, you had better address me at Hotel Champlain, Bluff Point, N.Y.

Yours truly,

R. W. RAYMOND,
Secretary.

McGILL UNIVERSITY,
MONTREAL, June 9, 1892.

DEAR MR. BELL,—In reply to your favor of the 6th inst., I have no hesitation in saying that the University will be glad to do all in its power in aid of the proposed meeting of Mining Engineers. The details would have to be discussed later, and will be modified by the fact that the time mentioned is in the College Session, and that our classes would be going on during the time of the meeting. This, while it would limit our available space, might be an advantage in other respects.

truly yours,

J. WM. DAWSON.

After some discussion, it was resolved, on the motion of Mr. D. A. Brown, seconded by Mr. Wills, to leave the details of the proposed Convention in the hands of the Council, to report at the next Quarterly Meeting of the Association.

THE LABOR QUESTION IN ITS RELATION TO CANADIAN MINING.

By J. Burley Smith, M.E., Glen Almond, Que.

In taking up this question as the subject of the paper I have the honour to read before you to-day, I find that however important and interesting it may appear to my view of the position, it is an extremely difficult and complex matter to condense within the limits of such a short paper as this must necessarily be.

It is at the same time a delicate subject to handle before an Association like this, on account of the social and political questions involved, which cannot be ignored in dealing with it either as an abstract problem or from the standpoint of employers who are pecuniarily interested in the employment of labor.

But it will not be forgotten that we have associated ourselves together, not merely to protect our interests as a trade organization, but with the higher motive of mutual improvement.

The labor question is one which employers always hesitate to discuss publicly—partly, perhaps, because there is a half consciousness that we have not been quite guiltless in our dealings with labor, and that free discussion might stir up our inner consciousness to a higher sense of duty and impel us to a line of conduct inimical to our self-interest.

A serious point for our consideration is the scarcity of good miners in Canada, even in the present extremely depressed state of mining industries of all kinds; and there can be no question that in spite of the efforts of the Government to encourage emigration from the older countries, there is always a scarcity of labor; and it is strange that in spite of the great number of emigrants coming into the country all the time this scarcity should exist. It is stranger still to observe the curious exodus of labor which is going on constantly from Canada to the United States.

I have noticed that during the last two or three years that whatever may be the state of our industry, whether active or depressed, there is always the same difficulty in keeping up a complement of efficient miners and it has been found necessary to increase the number constantly by the use of agricultural labor.

It would, therefore, appear that the ranks of the miners are being constantly and regularly recruited from the farmsteads, to whose sons the activity and change from a hum-drum monotonous life offers an attractive charm.

There would be nothing especially remarkable in this, as it occurs in all countries, still it is always injurious to the general prosperity of a country and shows there is something economically wrong when the laborers leave the cultivation of the soil in too large a proportion; and it is a very serious thing indeed in a new country when these men, having deserted the land for the mines, got some knowledge of mining and accumulated a sufficient sum of money to travel with, leave the mining field of their own country for that of a neighboring and richer one, from which they seldom return.

In older countries the occasional depressions in mining are always accompanied by the inevitable distress of the unemployed, who do not, however, necessarily leave the district or country, except in the case of those who are induced or assisted to emigrate, either by the too often specious promises of the emigration agent or the pecuniary assistance of well-meaning, though perhaps mistaken philanthropists.

There can, however, be no two opinions as to the value of this surplus labor as emigrants to a new country like Canada, with her vast undeveloped resources, and there is every excuse to be made for the large expenditure incurred yearly for this purpose, providing that this imported labor remains in the country, and does not, as is too often the case, make this a halting place only and pass on to the neighboring United States, ever ready to receive them, even though at Canada's expense.

Here, in times of depression, one does not see this army of unemployed and the palpable distress accompanying it, and though the storekeepers and tradesmen of the affected districts complain of and undoubtedly feel the bad times, it is not analagous to that of old countries, or even that of the United States, and it would seem, therefore, as if this draining off of the population to the United States was a silent yet steady exodus (unnoticed except for the continual bankruptcies of storekeepers and the figures of the census returns) which, in spite of the enormous importation of foreign labor, tends always to keep down the population and natural increase of the national wealth.

Though the mineral wealth of the Dominion is magnificent and the efforts of speculators to boom and develop it unremitting, the industry cannot by any means be considered flourishing.

It is, however, within the bounds of possibility that the rapid discoveries and inventions in the industrial arts of modern times, may, in the near future, create a new and sudden use and demand for mineral products, and a period of unexampled activity and prosperity come to us, and in such an event we may be quite sure that the labor question would be a very serious one to consider at that moment, and it is quite certain there would be great difficulty in getting a sufficient number of efficient miners to work and enable mine owners to take full advantage of it.

Such mining activity would not necessarily mean a rush of labor to the scene of it. It is only in the event of the sudden discovery of fabulous finds of the precious metals that a rush is made by all kinds of men, who, however, do not swarm there with a view of finding work so much as of participating in the general luck. One never hears of an asbestos, coal, copper or phosphate rush. We do certainly hear of a boom sometimes, but that does not attract any considerable number of men who are of over-anxious to labor.

The labor question before us is an economic one, and can only be determined by the conditions which affect all wage labor, whether miners or weavers, and it is from this point of view that we employers have to look at it.

Granted that there is a scarcity of miners in the proper sense of the term, and that this scarcity would be felt still more in the event of the prosperity we are anticipating, and granting that there is a constant shifting or moving on of the population to the neighboring county, it remains for us to consider the cause of this state of things in order better to find a remedy. And it is a matter worthy the consideration of all patriotic Canadians, because no greater calamity could happen to a new country requiring all her population for her own welfare and prosperity, than for her people to find that they can be individually more prosperous and happy in an adjoining country than in their own.

Primarily it must be admitted that the great attraction for Canadian miners in the United States is the higher rate of wages; and although it can be shown that this does not necessarily mean a greater acquisition of wealth to the recipient, because the well known conditions of wage labor, which have been reduced to a formula known as the "*Iron Law of Wages,*" proves that wages, however high, are never much above the cost of maintenance. Still they are higher there than here, and have the attraction of the higher figure to those who cannot naturally be expected to look at it from an economic point of view. To a single man, having only himself to provide for, it appears a great advantage, for he is able to save or spend, according to his proclivities, the balance in excess of his necessities. But to the people in the aggregate it is not, because the married family man does not receive any more wages than the single man, though he has much more to pay out of it.

The wages in Great Britain are considerably less than in the United States, yet the work people enjoy the same amount of comfort—that is to say, their wages buy nearly as much as they actually need.

The thrift and economy of a people collectively does not necessarily mean an increase of wealth, though individually it may raise one's personal condition above the rest of the community.

The higher figures of the United States do undoubtedly attract Canadian miners as well as laborers of all kinds. The rate of wages is pretty nearly the same or likely at any time to become in all the States, because although they have a policy of protection on the common frontier they enjoy absolute free trade amongst themselves. Canada, adjoining a number of these States, cannot alter the conditions of her labor market to suit this order of things, and cannot therefore, prevent the exodus of her people by offering the same high wages, because her labor market is ruled by her own politico-economic conditions, which are different to those of the United States.

The rate of wages in the United States is higher than it is in Great Britain because of the former's policy of protection, which imposes a duty on imported goods, with the result that the consumer pays the productive cost of these goods in unprotected or free trade countries, plus the duty imposed, and a little more. This increased price increases the cost of maintenance and raises his wages to meet this and no more.

The rate of wages is higher in Canada than in Great Britain, and lower than in the United States, because her geographical position will not allow her under present conditions to have the same measure of protection as the United States, or the same measure of free trade as Great Britain, the rate of her wages being subject to the same economic laws which govern the cost of production everywhere. At the same time it must be borne in mind that these economic or natural conditions are at all times liable to be interrupted by the misgovernment of a nation, by bad laws, by unfair taxation, by wanton waste of public treasure, by peculation and the sacrifice of the common weal to the private interests of those who are elected by the people to represent them in her councils. This is the political situation, and is dangerous ground.

The social view of the position perhaps touches us more intimately, as we must be more or less familiar with the social life of those laborers we employ in our mines, and as far as my knowledge and experience go I cannot help thinking that our disregard of the personal comfort and social wants of our miners has had not a little share in causing the exodus of this class of labor.

The housing of the men and the food supplied to them have not been as creditable to us as such matters should be, and savors not a little of the iniquitous "truck and Tommy" system of the old countries of fifty years ago, happily now a thing of the past.

It would appear as if our method of barracking and feeding the men had been copied from the lumbermen's shanties in the backwoods, for which there may have been some excuse, considering their extreme isolation and the difficulty of getting supplies. But the system is not well adapted to mining settlements, which, from economical reasons of transport, are never very far away from civilization and means of communication with the rest of the world.

The system common in mines—of paying wages and board and deducting an arbitrary sum from the former to pay the latter—is not a just dealing, and leaves too many openings for peculation on the part of managers, bosses and board masters, and does not leave the workman free to economize his earnings to the best advantage, and can only be designated as "taking it out" of the men.

The plan of barracking and boarding the men tends also to make the miners roving and shifty as a class, and careless and disinclined to settle; and I cannot help thinking that if more cottages were built by mine owners, or land given for miners to build cottages around the works for themselves, we should have a much more stable and settled mining population. The men would marry and become domesticated; they would cultivate gardens and perhaps small farms, and thus have other leisure occupations than horse play and cards and the inevitable quick-step and fiddle. Population would increase and there would always be an hereditary race of miners springing up. It is superfluous to remind you how beneficial this would be to a mining country. It is hard to pass this subject without paying a deserved tribute of praise to the owners and managers of the mines we have visited to-day, for whilst passing through the mining settlements of Thetford and Black Lake, with their neat and pretty cottages and the unmistakable signs of general comfort and happiness, it was impossible not to feel that the asbestos region had already realized what some might consider a dream of Eutopia. I regret to say that this is not the case in all the mining districts of Quebec.

If a mining population could be established on a more settled basis, schools—the great want of which is most seriously felt in the neighborhood of many mines—would be established as a matter of course, with enormous advantage to the rising generation.

Canada, with her boasted educational system, seems to neglect the miners and outlying districts altogether. In our district some time ago I made out a list of over thirty families with grown up sons and daughters who were unable to read or write; and this evil is more disgraceful from the fact that in many instances the parents could both read and write. On our side of the river Lievres the nearest school is five miles away, the road to which is impassable in winter.

The custom common in so many mining districts of Canada, of closing down mines in winter, cannot be defended. It has the effect of practically leaving the miners six months out of work during the year. This alone must have the effect of driving them to seek more permanent and regular employment elsewhere. It is a bad system altogether, for while the workmen drift away to other parts the capital of the employers invested in plant and machinery, to say nothing of that expended in opening out and developing the mine, is lying idle and unproductive during this period, and though the works are stopped there are certain fixed charges which go on all the same. There is, moreover, really no necessity for it, if the mining is carried on scientifically and on correct principles, because nearly all mines—I do not refer to quarries—can be worked more economically by subterraneous excavation than by open cast, the latter being ill-adapted for such a climate as that of Canada, with her deep snows and severe frosts. With a proper system of underground working there is nothing to prevent mining operations from being carried on all the year round to the greater advantage of both owners and laborers.

It is quite evident that if miners have to earn enough wages in six months of work to support them for the remaining six months of enforced idleness they will require a higher rate of wages for the period they are able to work. The fact of miners getting so heavily into debt as they do with the storekeepers of the neighboring villages proves the economic truth of this. I am sure all of us are familiar with the regular visits of the bailiff with his writs of seizure on the miners' wages for old debts, most of which, I find on enquiry, have been incurred during the unemployed winter time. And it may not be out of place here to express my heartfelt opinion that nothing could be more unfair to the workingmen of our Province than this harsh law of seizure for petty debts. A man incurs a debt for the necessaries of life, say during the unemployed time of winter: this is allowed to run on; interest accumulates; the creditor obtains judgment against him; costs are added to costs, until shortly the unfortunate debtor finds himself saddled with a debt of twice the original amount, and with diminished power of paying it, and a seizure is made, not merely on part, but the whole of the wages coming to him. The employer is appointed garnishee and is himself held responsible if he fails to pay over the man's wages to the court, and thus finds himself a party to a transaction of which he is ashamed. On enquiry he finds that only one-fourth of the amount due to the man can be legally taken; but to carry this out he has to attend the court to make a declaration as to this amount, which entitles him to his expenses if he chooses to claim it. Further costs are thus added to the burden already to heavy for the debtor, and he usually finds that hard as it is, it is better to pay the whole of his wages, even though his wife and family have to starve or incur fresh debts, or "skip." Can it be wondered at that there is an exodus? Is it credible that these men have votes, that they send representatives to Parliament, without asking for the repeal of such laws?

After these remarks I think you will agree that the labor question is one of the deepest importance to the industry we represent, and that the miners, *i.e.*, the producers of mineral wealth, are unavoidably involved in the question of successful mining, and that it is incumbent on us as an Association to care for the welfare of our miners from motives both of policy and duty.

It behooves us to enquire into the political view of the question and to use the strength of our organization in effecting such constitutional reforms as are desirable for bettering the condition of our miners in order that they may not be driven out, but remain to develop the mineral resources of Canada, and especially our province.

It behooves us to look to ourselves and see that the social welfare of our miners is not neglected. And bear in mind, gentlemen, that Canadian miners, taken as crude material, are as fine a class of men as can be found anywhere, and that our neighbors in the United States are well aware of it, and are—so much the worse for us—always ready to welcome and employ Canadian mining labor and pay more for it.

THE CANADIAN ASBESTOS INDUSTRY.

By L. A. Klein M.E., Black Lake, Que.

The asbestos industry of Canada has assumed a rank which makes it well worth while to study how to further develop the same, and many have turned their eyes towards our Province and its serpentine regions: Governments, capitalists, mining men, speculators, prospectors and so on —all have contributed in their own way to this purpose.

Many things have been said and written on asbestos, asbestos formation, asbestos industry, asbestos uses and markets, and it is certainly not the lack of talk on the subject which has induced me to take it up for this paper. I have been led to do so in consideration of the facts that by former writers on the subject a good many practical points have not been touched—points which must be of special interest to those who are about to interest themselves in the industry, be it with money, be it with actual work—but also in consideration of the fact that amongst those not intimately connected with the industry, opinions of an altogether erroneous nature as to the value and character of the industry are spread about, which may occasionally lead to a very inconvenient disappointment. There are even a good many things amongst us mining men out here on which the difference of opinion has not as yet reached a settlement, as it is naturally with an industry in such a young state as ours.

I have tried to get the co-operation of all my fellow miners in the industry to make my statements as complete as possible, and I tender my heartiest thanks to those who have complied with my request. I must, however, add that the opinions expressed in this paper are individual and under no other authority than that of my own observations and my own judgment.

I had still another object in delivering this paper, and that is to show the asbestos industry in Canada from a national and economic point of view, or in other words, to look at it as a whole and a resource for our Province and the Dominion of Canada, respectively.

You have to-day looked over the asbestos mines in Thetford and Black Lake, and while the time has been very limited and no chance whatever could be given to follow up a special line of the business in which we are engaged, you have, however, had an opportunity to see in general the mode of occurrence and production of asbestos. While you have done so you have seen the area which I may safely say produces about 85% of all the asbestos used in the world.

Serpentine covers quite a large area in Canada and especially in the Eastern Townships of Quebec. It is not my object to-day to describe its extent, which has been done in an exhaustive way as well by members of the Geological Survey as by the authorities of our Provincial Government, but I will confine myself to those districts which have as yet received prominence and which practically supply the demand of the world. These are in the districts of Thetford and Black Lake, with some more or less encouraging developments to the north and south; the district of Danville, with, so far, one prominent mine in the production of asbestos; and the Templeton district, in which, however, the industry has not yet assumed more than an exploratory character.

If you compare these very limited areas representing the region of the big serpentine belt which produces asbestos in a quantity and quality which will, economically worked, yield a profit to the investor, with the comparatively enormous extent of serpentine rock, you will readily come to the conclusion that it takes more than the finding of the serpentine to have a paying asbestos mine, and that is one point I would like to pick out and submit to your consideration.

While the undoubted success of some of the existing mines, in combination with erroneous ideas on the formation, occurrence and of production and so on, nursed by speculators, lead many to believe that they struck a fortune when a locality was shown to them which contained serpentine of a very good or just the right color, with occasionally a small asbestos seam in it; and while many have been induced to spend a considerable amount of money under these false impressions, I may state that not one enterprise has proved successful in this industry which has not had anything else to look on than serpentine of a good color. All those successful mines had as surface indications asbestos in good and large veins of real commercial value, and I do not hesitate to say in some cases larger veins than they can get to-day. We may be unable to declare a locality worthless as an asbestos mine, judging from color and sections of serpentine, but I am certain that neither I, nor any of my confréres who have devoted some of their time to the study of the subject would commit ourselves in recommending a locality as an asbestos mine from the good look of the serpentine, without having seen besides really valuable and marketable asbestos veins in sufficient quantity, and this notwithstanding the expression of one of our scientific authorities that the rock likely to prove asbestos-producing can be determined by certain peculiarities of texture, color or weathering.

I will not take up your time with a detailed description of the mineral, but merely make a very few general remarks.

Asbestos is a fibrous variety of serpentine, and is, chemically speaking, a hydrous silicate of magnesia. From several analyses of a number of specimens all over the world, which I had at my disposal, the percentage of silica is from a little over 40 to 40½%, while magnesia is from 41½ to 43%; other more prominent admixtures were ferrous-oxide and alumina in quantities of from 1 to 3%, and further, traces of lime, potash, soda, chlorine and sulphuric acid. This composition is completed by water, to which we have to attach the most importance from a business point of view. This, of course, is not water in the form of a moisture, but water intimately associated with the silicate of magnesia. The importance of this water has been shown by the fact that good and fine asbestos fibre, may it be from the Italian variety or from the Cambrian rocks of the Eastern Townships, or the Laurentians from the north of the St. Lawrence, contains from 13½ to 14% of this water, while some very harsh and brittle specimens of asbestos have shown considerably below 12%. Experiments have further shown that it is comparatively easy to dissociate a part of this water from a fine and silky specimen of asbestos fibre and to render the same hard and brittle by heating it to a certain extent. This peculiarity leaves us to conclude why we find such considerable differences in the qualities of asbestos in comparatively close proximity, as, for instance, the larger percentage of "thirds" in Black Lake than in Thetford; and then even at the best mines, qualities of no, or very little, commercial value. The asbestos in these localities has been rendered harder by the influence of heat through the intrusion of heated matter, following the original formation of it, and this heated matter has been the masses of granulite which we find throughout our serpentine region, with the exception of a small knoll of serpentine in Thetford, where granulite appears only in very small dykes. And here is another point where I differ from some of our fraternity who hold that the presence of these masses of granulite are a good indication of asbestos—a theory which I think can scarcely be maintained, at least, however, as to asbestos of commercial value, in the close neighborhood of these masses of granulite.

Thirteen incorporated companies, with an authorized capital of about three and one-half millions of dollars, of which a part, however, is employed in the manufacturing business in England, with a number of very prominent private concerns, occupy themselves to-day with the production of asbestos and asbestos mining, and I believe that my estimate that about two and one-quarter millions of dollars are invested in the industry in Canada comes very close to the reality.

While until about four or five years ago, with one single exception, hand work, occasionally connected with horse-power hoisting, was exclusively used in asbestos mining, the leading mines are now equipped with more or less extensive plants of machinery to carry on the work.

This work consists,

Firstly—Of the proper mining operations, such as the drilling, blasting, removing of the broken rock out of the pits to the dumps, hand in hand with the gathering up of the asbestos veins and transport of same to the dressing establishments or cobbing sheds.

Secondly—The dressing or cobbing, that is, the separating of the asbestos fibre from the adhering rock and the grading of the former in different qualities, followed by packing, transport to railroad, loading, shipping and marketing. It may not be unwise to review these different operations shortly, as the circumstances under which asbestos is produced are entirely different from nearly any other mineral or ore, and we find nearly every item which we were used to consider as a thoroughly established rule, greatly changed by these circumstances.

This is readier understood when we consider the large amount of rock which has to be handled in comparison to the mineral, the peculiar nature of this rock, the character of the mineral, which is a fine silky fibre, and must be carefully protected from injury and so on.

As to the drilling, hand drilling is still in exercise in all the newly opened mines for prospecting work, and even in one or the other of these mines which have already reached considerable prominency. It is further nearly exclusively used for block-holing—only very recently one of the mines has introduced a small size machine drill for the purpose. It is done by three men with 1 inch octagon steel, and 6 to 7 lb. hammers. The average capacity is about 15 to 16 ft. a day, of 10 hours, and the cost about 20c. per ft. The depth of holes is thus seldom exceeding 4 ft. Some of the mines have not long ago adopted a plan of block-holing with one man only, using ¾ inch steel, and 3 to 4 lbs. short-handled hammer. The capacity is thus about 8 feet for 10 hours' work, and the cost only about 14 cents.

Most of the mines do their drilling, however, with steam or compressed air, 45 ft. per day of 10 hours in the former case, and from 50 to 55 feet in the latter being considered a fair day's work. The expense per foot may be set, considering the present prices for fuel, at from 7 to 8c. per foot, not including wear and tear on machinery and interest for capital involved in the buying of the necessary machinery. There are in all 7 compressors with a total of 44 drills capacity in use, 4 of them being built by the Rand Drill Company, 2 by the Ingersoll Rock Drill Company, and 1 by the Norwalk people. At present also, 44 steam drills are employed in the industry, of which, however, 11 are run by steam. About one-half of all drills in use are Rand's Little Giant No. 3, 3 Rand Sluggers, 5 Ingersoll 3 inch, and 12 Sergeants—a couple or so being of other manufacture. The steel in use is 1¼ octagon and costs in the neighborhood of 10c. a pound. As a rule the drills are worked under 80 lbs. pressure to the square inch. We may consider an expense of 3½ cents to the ton of broken rock as the average cost at present.

The blasting is now generally done with dualin, which contains about 35% of nitro-glycerine, of which the cost is at present 20c. per lb., but which price will be very likely further reduced through the competition of a newly erected powder factory in the district. With all of the larger mines the blasting is done by electricity; still there are some which hold to the system of one-hole blasts, claiming that by this system less of the asbestos veins are smashed to small particles and scattered all over the place, therefore involving more expense to pick them up. The expense for explosives is about 3 cents to the ton of rock broken.

The next operation is the removing of the broken rock from the pits to the dumps with which the picking up of all the asbestos veins goes hand in hand. If the bottom of the pits are on the same level with the top of the dumps, the operation is simply to load the refuse rock on trucks, stone-boards, wheelbarrows, etc., and bring it by one or the other of these means to the dumps; where this is not the case, as in most of the more extensively worked mines, where pits vary in depth from about 30 to 150 feet, the rock has to be hoisted up by means of derricks. At the disposal of this industry there are at the time about 75 derricks, of which, in two cases hand, and in twelve or thirteen cases horse power is applied as motor, the rest being steam derricks. Hand and horse derricks have of course only a right to exist where there is a comparatively small amount of rock to be handled and where the works are of a more or less exploring character only, and the first expenses of putting in steam plant seems unadvisable. The steam derricks are to be distinguished in two classes, boom and cable derricks; from the latter class only two being so far in use. Boom derricks consist of a mast held by means of guys in a vertical position and turnable on its own axle, while to the foot of the mast a boom or arm is attached and suspended in a more or less horizontal position by means of ropes stretching from end of mast to end of boom. The length of the latter is generally from 40 to 50 feet, and it is clear that the working space of such a boom is limited by its length and can, economically, hardly be extended to more than say 50 feet.

The cable derricks have a mast somewhat similar to the former, but instead of a boom, a cable with a traveller on it, which cable is stretched from top of mast to some point across the pit, allowing by means of the traveller, to hoist from any point of the cable. As this my be stretched to a length of 400 and more feet the enormous advantage over boom derricks seems clear, and I have no doubt that its general introduction is only a question of time. The ropes used for hoisting are ⅝ to ¾ in. crucible cast steel, the guy ropes generally ⅞ of an inch.; the cables 1½ or 2 inch steel ropes.

There are eighteen double and twenty-four single drum hoisting and winding engines employed in the industry, or a total of sixty drums. The so hoisted refuse rock is placed on lorries and wheeled out on the dumps either by hand, or, where the dumps are somewhat long, by horses, and there discharged. In some of the mines, to a great advantage, self-dumping cars of a very simple construction are being used.

While now nearly all the larger mines use iron or steel rails, and lately, specially of the lighter sort, (19 lbs. Canadian make, at a price of $40 per ton delivered), there are still some wooden rails with band iron top in use, which practice, however, with the growth of the industry, will have to be soon abandoned.

The transport of the crude asbestos to the dressing or cobbing sheds is in most cases done by the simple means of a cart and a horse, or where sheds of a more or less provisional character are placed right on the edge of the pits, carried in by hand. Where the cobbing is more concentrated in a special and permanent establishment we find rail connection for the purpose. Two of the mines, however, have a more or less systematic handling of the stuff in this state—consisting of iron self-dumping skips, which are loaded directly from the pits, hence they proceed down an inclined railway and discharge their loads directly in the cobbing establishment. The skips are brought back by means of winding engines. The cost of the above-described operations, viz: Removing of refuse rock, hoisting, picking of asbestos and its transport to the sheds, are of course somewhat influenced by the size of the veins in the respective bed rock, the height and accessibility of the pit's face, length of dumps, and so on, but may with fair certainty be placed at 22 cents per ton of rock handled in summer time, which figures unfortunately increase in winter time, in some cases to 35 cents, and may be accepted with 25 cents for all year round work.

The second part of the operation at the asbestos mines is the dressing, or commonly called cobbing, which comprises the freeing of the asbestos veins from rock as much as possible (the crude asbestos in the market still contains from 15% to 40% of rock, some manufacturers even claim more than that while they are negotiating new contracts), and the grading in two, three or four different grades. This operation is as rule done by hand by little boys, with the aid of a hammer weighing about 1½ lbs. Some of the mines, however, have partially or entirely adopted the aid of machinery, and this more particularly for the transformation of the so-called cobbing stones—*i.e.*, larger pieces of rock with a more or less valuable asbestos vein in it, a vein, however, which did not give away from the blast, and which requires the breaking away of the adhering rock by means of powerful blows (sledge hammers), or compression (crushers). The first to try and solve the problem was the Scottish

Canadian Asbestos Co. Unfortunately the development of the process sustained a sudden interruption by the closing of the mines in the autumn of 1888. Their plant consists of a 50 h.p. engine, Blake rock breaker, travelling picking tables, set of Cornish rolls, revolving screens, elevators, shakers, two large blowers, and so forth. Next the American Asbestos Co. started in to experiment in the winter of 1890-91. The main object then was to do away with the somewhat indistinguishable grade of No. 2, an object, however, which was difficult to reach, unless the fibre could have been thoroughly loosened and freed from stone. Their plant consists in the main of a Blake crusher, to which the crude asbestos is conveyed by an inclined railway, and automatically dumped in front of the crusher. The jaws of the crusher are set at 1½ inches, the crushed stuff drops on an inclined sieve in shaking motion, which separates all the loose fibre and the dust from the larger pieces of rock and asbestos veins, the former going directly to the cleaning or grading machines, the latter dropping on a revolving picking table, where the barren rock is removed by hand to one side of the table, the asbestos veins being left on the other. At the end of the table is a receiving chute which is divided into two compartments, and into which rock and asbestos are discharged respectively. The rock drops from the chute directly into a lorry and is wheeled to the dumps, while the asbestos is conveyed either to the dry kilns, as neccessary in winter time or rainy weather, or to the fine crushers for further manipulation. These latter are of unique construction, of which the object is to allow particles of a certain size and loosened fibre to go through, without being further crushed, as thereby the asbestos fibre is likely to be injured This so reduced stuff is brought to the cleaning and grading machines, consisting mainly of a set of inclined sieves in rapid shaking motion in connection with blowers, fans, etc.—remaining unbroken stone and unloosened fibre going back to a set of still finer crushers to undergo the process again. The plant at King Bros. mines in Thetford, which was principally erected for the extraction of asbestos out of large pieces of rocks on the old dumps works—which some years ago did not warrant the expenses for block-holing and further handling—consists of a Blake crusher from which the stuff is conveyed on a set of Cornish rolls with the intention of having all stone reduced to powder—from there to a revolving screen of which the object was to screen out all the dust and leave the clean fibre. This object, however, has not been fully realized, owing to the failure of the rolls to break up the rock entirely, and an additional blowing and screening plant has been put in, which produces now a very clean product of one grade. The Anglo-Canadian also runs a crusher and a set of sieves, and the Johnson's Co. has recently put in a couple of crushers to overwork the old dumps. None of the processes at their present state, however, may as yet be considered complete, the main difficulties being two :—

1. That, if asbestos is crushed with a considerable amount of stone together until the latter is reduced to powder—the long and most valuable asbestos fibre is partially destroyed.

2. If the stone is not entirely reduced before grading it is nearly impossible to free the fibre from the stone, and a large amount of waste is the result.

Besides, development of this part of the industry has to stand other very trying circumstances, as the objections of a good many of the manufacturers to buy prepared fibre; the trouble with the Customs, which is rather inclined to classify the so prepared asbestos as manufactured, and to levy a duty of 25 per cent. of value on same, and the considerable amount of low grade waste which is found very hard to dispose of.

The cost of cobbing varies, of course, considerably, according to the quality of material. While some stuff will break from the stone very easy, other requires considerable labor; then larger veins will sooner be gathered than small ones, and while some stuff occasionally may be contracted at $3 per ton (this, however, never includes the manipulation of cobbing stones), others may cost as high as 15 or 18 and more dollars per ton. I believe that, including the breakage of the cobbing stones, $7 is the average cost of cobbing of asbestos for a ton at the leading mines of this section.

The stuff after being graded, which is, however, in the entire discretion of every particular mine, (prices of some number 2 and number 3 last year differed about 400 per cent.), is put in bags of 100 lbs. each. Cost of bags are from 5 to 6 cents each, cost of bagging, 20 to 25 cents per ton. The cost for transport to cars and loading on this section varies from 10 to 60 cents a ton, according to distance from railroad.

To complete this part of my statement I may add that in this industry there are 40 boilers with a capacity of 1825 horse power, and about 2,000 men employed. The value of plant, that is, machinery, buildings for stores and dwelling purposes, water reservoirs, roads, etc., is estimated at $355,000.

If I try to give now in the following an idea about the cost of asbestos mining it must be understood that it cannot be applied to any individual mine. The cost or every one will naturally depend in first line upon the quality of the ground the mine is on, and upon how near the respective mine comes to the average with regard to purchase price, invested capital or plant, expenses of management, and so on. As to the quality of ground I have, therefore, chosen to calculate the expenses on the ton of rock, and the cost of asbestos production will depend upon how many tons of rock in a certain mine have to be removed in order to produce one ton of asbestos. On this subject the opinions of the asbestos miners are considerably different, and while some claim to mine only on 50 or so tons of rock to the ton of asbestos, others go as high as 150. I am of the opinion that as a rule the quantity of rock mined to the ton of asbestos is greatly underestimated. Basing, on the capacity and actual work of our machinery appliances, the known quantity of lorry loads removed from a mine during a year, and the known average weight of each load, in relation to the totals of asbestos produced, I hold that 1 ton of asbestos to 100 tons of rock is a fair average. If we accept this the cost of production of asbestos may be set down as follows: drilling, 3½ cents; blasting, 3 cents; labor for removing rock and gathering asbestos in the pits, 25 cents, making a total of 31½ cents to the ton of rock, or $31.50 to the ton of asbestos; $7 for cobbing; $1.50 for bags and bagging; 50 cents for loading; $5.50 for supplies that includes fuel, tools, iron, steel, timber, other materials and repairs; $6 for general business expenses, such as mangement, insurance, offices, marketing and others; $3.75, 10 per cent. wear and tear, calculated on a total of $355,000 in plant and 9,000 tons production, making a total of $55.75 to produce one ton of asbestos. If we calculate now that we have to pay interest on a total invested capital of about two and one-quarter millions of dollars, for which at least 10 per cent. must be expected, we have in our sales to average a price of at east $80 per ton of asbestos. Relating to the totals of production for the last eleven years, the figures at my disposal show for 1891 an output of nearly 9,000 tons, with a value of about $1,000,000, thereby ranking thirds or fourths as far as value of mineral production in the Dominion of Canada goes, being exceeded only by the coal production, valued at about seven and three-quarter million dollars, and on about even terms with copper, petroleum and brick. The output of asbestos in 1880 (eleven years ago) was but 380 tons, amounting to $24,700. Since then the indusry has steadily increased, with the only exception of 1888, and has reached in 1890, 9,860 tons, with a value of $1,200,240, taking the official figures as given by the Geological Survey, which, however, seem to me rather high, especially as far as the value is concerned. During the period between 1880 and 1890, the increase has been nearly 2,600 per cent. in tonnage and 5,100 per cent, in value.

It may be interesting to see what the average value per ton of these last ten years has been, as this is the only measure by which we can judge the industry from a national and economic, as well as a business point of view. The years 1880, 1881 and 1882 brought to the asbestos miners a price of $65 in average, while the price per ton in 1883 reached $72. From here we find the average price steadily decreasing, owing to the large proportions of No. 3 asbestos, until it reached the lowest point in 1887 of $49. The respective figures are a trifle over $65 for 1884, $58 for 1885, $59.75 for 1886, and, as stated before, $49 for 1887; 1888 yielded an average of $60; 1889, $69.75, until 1890 brought the large figure of over $127 as an average price for every ton of asbestos, if the statements made by the Geological Survey are correct. This enormous increase in prices was due to several circumstances, chiefly relating to the state of the European market, and in particular that at the time a number of speculators had bought and kept from the market considerable amounts of stock in expectation of a further rise, while manufacturers as well, were anxious to lay in as much stock as possible, under the impression that the mines had nearly reached the top of their capacity, and that prices would be driven to the utmost if stocks should run short. The real state of affairs transpired only when speculators tried to unload. Here a reaction set in, and while manufacturers before were very anxious to buy, they then decided to first await a settlement of the affairs. This, however, was promptly answered with the slacking down in the working of the mines last summer, and led in consequences and in considerations of other obnoxious circumstances—such as the Quebec Mining Act—to the entire shutting down of nearly all the mines in November last. Since then things have somewhat changed.

It is clear that a mineral which has been successfully exposed to a heat of 4,500 to 5,000 degrees F, which is a non-conductor of electricity and which may be spun like cotton and flax, has its merits in itself and will stand on those merits. The uses of asbestos are steadily increasing. I cannot, however, dwell on this point, and have to refer those who are especially interested in the subject to an excellent paper read before the Asbestos Club in September last by Mr. Ed. Wertheim. One thing, though, I would like to mention with regard to the market for crude asbestos, and that is that it seems as if the American market is now rather inclined to buy as good grades as the European, while *vice versa* manufacturers on the other side of the water are taking up lower grades along with first qualities—circumstances which never prevailed before. So it seems that those two main buyers of our products—America and Europe—are coming on more even terms than ever before.

There is no doubt that the industry is still on a steady and very healthy increase, and while we may have temporarily to stand a slight reaction, things will brighten up before long. The sound judgment of those men interested in our industry will soon restore the balance between demand and production and will continue to develop the asbestos industry as wonderfully as they have done so far. The spirit of congeniality which assembles us to-day, and which has found its expression in the formation of the General Mining Association of the Province of Quebec and the Asbestos Club of Black Lake, will aid to this end for the glorification of the Dominion of Canada and its world-known asbestos industry.

RECENT PRACTICE IN ECONOMICAL AIR COMPRESSORS.

By F. A. Halsey, Sherbrooke, Que.

It has long been a source of surprise to the writer to note the degree by which the steam engineering of air compressors has lagged behind that of other consumers of power in connection with mine work. The indicated horse power, allowing for stoppages and averaged throughout the day, for the compressor of the average mine is not less, probably, than from ten to twenty times that of the hoisting engines of the same mine. Nevertheless, engines of the most refined and economical construction are often seen in use for hoisting purposes, while beside them will be compressor plants of, as stated, from ten to twenty times the developed power, and driven with perhaps plain slide valve engines. In the mining section, where, so far as the writer's knowledge goes, the steam practice is more advanced than elsewhere on this continent—Northern Michigan—the above statement is emphatically true. Hoisting and pumping engines of the finest and most advanced design and construction have been in use there for years as a matter of course, but until recently very ordinary engines have been considered good enough to drive compressors.

When compressed air mining machinery was first introduced it was of course of a somewhat experimental nature, and the air compressor occupied a less prominent position as a fuel consumer, both relatively and absolutely, than now. Under these circumstances it is not to be wondered at that the first compressors should have been built chiefly with a view to economy of first cost. That day, however, has long passed, and there is not now, as indeed there has not been for the past five years, any justification for the continued popularity of compressors designed in absolute defiance of every principle of steam economy. Persistent advocacy has indeed rendered the merits of the plain duplex type of compressor comparatively well understood; nevertheless, for the sake of completeness to the argument, it may be worth while to rehearse them here. The chief point of superiority lies in economy of fuel, the reason for which is as as follows:—

In compressing air the resistance of the air against the piston is nothing at the beginning of the stroke, from which it rapidly increases, reaching its highest near the end of the stroke. If steam is to be used with economy it must be cut off early in the stroke, after which its pressure rapidly falls, being at its lowest at the end of the stroke. Thus we have, at the end of the stroke, a high air pressure with only a low steam pressure to overcome it. If the steam is to be used with economy, as above outlined, the deficiency in the power of the steam must in some way be made up. To accomplish this there are two means at disposal with the duplex construction, while with the straight-line form there is none.

1st. The two cranks may be placed at right angles to one another, with which arrangement each steam cylinder is at its best advantage at that point of the revolution where the other is weakest.

2nd. A large, heavy fly-wheel may be employed.

The first device is, from the nature of the case, impossible of application with the straight-line form, and the second is almost equally so. While, of course, fly-wheels are added to straight-line compressors, they are entirely inadequate to the work required, for the reason that there is not room for wheels of sufficient diameter or weight, while in the duplex form there is plenty of room for any wheel desired. In duplex compressors it is customary to use a wheel of double the diameter and double the weight—that is, four times the regulating power—of the largest wheel which it is practicable to employ with the straight-line type of the same size of cylinder. The result is shown to the eye in trying to run the two types at a low speed; owing to the deficiency of fly-wheel the straight-line machine works with an unsteady motion, slowing up at each centre and stopping if a too slow speed is attempted, while the duplex works with a steady motion at a much slower speed than it is possible to run the straight-line at all. The duplex machines can be run with a full load at as low as ten turns per minute, while the straight-line form cannot be run with a load at a slower rate than about thirty to thirty-five per minute. The result of this superiority in fly-wheel capacity is, that while it is entirely feasible to run the duplex machines with the steam cutting off at one-fourth the stroke, it is not practicable to run the straight-line machine with a shorter cut-off than about two-thirds of the stroke, and the superior economy of the duplex machine is represented by this difference in the cut-off.

The practicability of using steam with an early cut-off, is not, however, the only source of economy in the duplex machine. The capacity for running with extreme slowness at times is an extremely valuable one in connection with regulation. It frequently happens in every mine that the demand for air becomes temporarily almost nil, and the feasibility of running with extreme slowness enables the duplex machine to be brought down to a speed which will meet this condition, but a speed, nevertheless, at which it is producing air in proportion to the fuel consumed. With the straight-line machine it is impossible to run with such slowness, and "unloading devices" are introduced to stop the machine from compressing air that is not wanted and can only be thrown away at the safety valve. This purpose is accomplished, but at the expense of running an idle machine, and also of forcing the air back and forth through the small passages of the unloading device. Of several indicator cards in the writer's possession, taken with this unloading device in operation, the most favorable shows an area of 14 per cent. of the regular compressor card, and if to this we add the percentage customary for the work of driving the idle machinery, we shall see at what a cost of fuel this unloading device accomplishes regulation.

The only objection that has ever been urged against the duplex compressor is, that it "produces a torsional strain on the shaft." Granted; but what is a shaft for? How many engines or other shafts are there in the world that do not carry a torsional strain? Who ever heard before that it was objectionable to have a shaft carry a torsional strain? In point of fact there is no strain except, perhaps, simple tension that is so easy to provide for and which gives so little cause for anxiety as torsion. What shall be said, however, of the alternate bending strain of the long cross-head of the straight-line machine? This is, perhaps, of all strains, the most difficult to provide for; and in point of fact, while no one ever heard of a duplex compressor shaft giving out, the same cannot be said of the straight-line cross-heads.

The above course of reasoning is so entirely in accordance with the first principles of steam economy that it has to a large extent prevailed, and the said plain duplex type of compressor has become a popular and standard one; but there the matter has rested. Despite the merits of the plain duplex, as compared with the straight-line compressor, no one in this day and age can claim a simple, non-condensing engine to represent a high development of engineering practice. Now it would seem that the first thought natural to a man after being convinced of the soundness of the above reasoning, would be: "But your duplex machine contains two steam cylinders; why not make one larger than the other, connect them in series instead of in parallel, and thus, at the trifling additional cost of a few pounds of iron and the boring and fitting of a large cylinder instead of a small one, secure all the economy of a compound engine—an economy so great that ten times the amount required here per horse-power is often expended to secure it, and the result proven to be a paying investment." Unlike hoisting engines, moreover, compressors are well adapted to be connected to a condenser, and where water is available no reason can be found why they should not be so connected. If our supposed enquirer were a little further versed in steam practice it would soon occur to him that since a compound engine requires less steam than a simple one, its boiler may be smaller, and that slight as is the additional cost of the compound condensing machine, it would be in considerable measure offset by the saving in the cost of the boilers.

The writer has presented arguments similar to the above for more years than he likes to own; but he has, until recently, presented them to deaf ears. During the past two years, however, there has been a decided awakening on this subject, and the American company with which he is connected, has put out a considerable and increasing number of compound condensing compressors, and the same influence has been at work to at least a proportionate degree here.

The first machine of this description built here is shown in the accompanying illustration, and a larger size has since been called for, the first of which is now being erected and will soon be in commission.

It is not necessary at the present day to present figures of fuel economy of compound engines to show that the money spent on them is well invested; nevertheless, the adaptability of the duplex compressor to compounding is so great, and the consequent additional investment is so small, that the figures in the present connection are of such a surprising nature that the writer gives them as a matter of general interest. The writer's firm was, on a recent occasion, asked to furnish alternative bids for three plants of the same capacity, boilers included, but of the straight-line, plain duplex and compound condensing duplex types, respectively.

The figures submitted furnish the basis of first cost, from which the following results are obtained. As a basis of fuel consumption the compound condensing compressor is rated at 2 lbs. of coal per horse power per hour, and the plain duplex at 3½ lbs., which figures fairly represent the results from those types of engine when operated under working, not test, conditions. Of the straight-line machine the writer is not aware of any careful measurements having been made, but considers 5 lbs. per horse per hour as a fair assumption. Using the above as a basis, it is a simple matter of multiplication to determine the length of time necessary for the more expensive plants to return the additional outlay in the saving of fuel effected, and the astonishing results obtained are, that with the compound compared with the plain duplex, the extra first cost of the former will be returned in three months; with the compound as compared with the straight-line, in four and one-half months, and with the plain duplex as compared with the straight-line, in six months. In these calculations the mine is assumed to run two shifts of ten hours each per day, and coal to cost $4 per ton.

The illustration (appended) shows a compressor fitted with the writer's positive-motion air valve gear. The subject of this paper relates, however, to the economics of air compression, and no description of the valve gear will be made further than to call attention to the fact that the suction valves are surrounded by hoods properly fitted for connection to flues for leading cold out-of-door air to the compressor. This is a minor source of economy which has been strangely neglected in the past. The economy of fuel obtained by this provision is one per cent. for each five degrees difference of temperature between the inside and outside air. In a climate like that of Canada this can be easily made to aggregate eight or ten per cent., and there are few sources of economy of that extent which can be secured at such a trifling outlay.

After a vote of thanks to the Chairman, to the asbestos mine owners for their generous reception and entertainment, and to Messrs. Halsey, Smith and Klein for their papers, the members adjourned to the dining room, where an excellent repast was provided. Col. Lucke presided. During the evening a number of songs and speeches were given, and an enjoyable gathering did not break up until a late hour.

EXTRAORDINARY GENERAL MEETING.

MONTREAL.

WEDNESDAY, 20TH SEPTEMBER, 1892.

An extraordinary General Meeting of the Association was held Wednesday, 20th September, in the offices of the Treasurer at Montreal. Among others present were :—

Hon. George Irvine, Q.C. (Johnson's Co.), Quebec, *President*,
R. T. Hopper (Anglo-Canadian Asbestos Co.), Montreal,
J. Burley Smith, M.E. (British Phosphate Co.), Glen Almond,
Dickson Anderson, Montreal,
Capt. Robt. C. Adams (Anglo-Canadian Phosphate Co.), Montreal,
S. C. Stevenson and A. W. Stevenson, Montreal,
Hon. John McIntosh, Compton,
W. E. Bell, Toronto,
B. T. A. Bell, *Secretary*, Ottawa, and others.

Hon. Mr. Irvine presided.

The meeting having arranged some preliminaries anent the forthcoming Mining Convention, proceeded to discuss Quebec's mineral exhibit at the World's Fair. The Hon. John McIntosh, Commissioner of Quebec, explained that the Government's grant for the whole provincial exhibit amounted to but $12,000. He asked for the co-operation of the Association, promising free transportation of and safe return of specimens. He thought that the exhibits should be properly explained by some competent person conversant with the mineral industries and the extent of the Province's resources, and asked that the expenses incident to this might be borne by the operators. Mr. S. C. Stevenson, who has had much experience in Government exhibits in different parts of the world, claimed that the principle of the various provinces being represented by independent exhibits, in addition to a general exhibit by the Federal Government, was wrong. In minerals there was at Ottawa in the museum of the Geological Survey, an unrivalled and thoroughly representative collection which should be utilized.

The Government at Quebec could not make a better, and representations should be made to have this collection sent.

After some further discussion by Capt. Adams, Mr. Hopper and Mr. J. B. Smith, it was moved by Capt. Adams, seconded by Mr. A. W. Stevenson, and resolved:

"That Mr. James King, M.P.P., Mr. J. Burley Smith and the Secretary be a committee to co-operate with the Hon. John McIntosh, and that said committee be authorized to interview Dr. Saunders, the Canadian Commissioner at Ottawa, with a view to securing the co-operation and assistance of the Dominion Government in the proposed exhibit of minerals from the Province of Quebec."

The meeting then adjourned.

QUEBEC MINERAL EXHIBIT.

INTERVIEW WITH THE CANADIAN COMMISSIONER.

OTTAWA, 4TH OCTOBER, 1892.

On Wednesday, 4th October, a deputation consisting of Mr. J. Burley-Smith, Mr. W. A. Allan, Mr. Hector McRae, and Mr. B. T. A. Bell, *Secretary*, had an interview with Dr. Saunders, Canadian Commissioner to the World's Fair, Chicago, and urged upon him the necessity of securing some assistance from the Dominion Government, to aid in making as complete as possible the exhibit of minerals from the Province of Quebec to be sent to Chicago. Dr. Saunders promised to do what he could to further the objects of the deputation.

MEETING OF COUNCIL.

MONTREAL.

FRIDAY, 14TH OCTOBER, 1892.

On Friday, the 14th October, a special meeting of the Council was held at the office of the Treasurer, Mr. A. W. Stevenson, 17 St. John St., Montreal. There were present:

Col. Lucke (Beaver Asbestos Co.), Sherbrooke,
J. Burley Smith, M.E. (British Phosphate Co.), Glen Almond,
R. T. Hopper (Anglo-Canadian Asbestos Co.), Montreal,
J. Lainson Wills, F.C.S., Ottawa,
O. M. Harris, Montreal,
J. Keith Reid, Buckingham
A. W. Stevenson, C.A., Montreal,
B. T. A. Bell, Ottawa.

There were also present:

Mr. R. G. Leckie, Managing Director Londonderry Iron Co., Londonderry, N.S.
Prof. B. J. Harrington, Montreal,
Prof. H. T. Bovey, Montreal,
Dr. Johnson, of McGill University, Montreal,

In the absence of the President, Col. Lucke was called to the chair.

The Secretary read the following letter from Sir John S. D. Thompson, Minister of Justice, with reference to a grant from the Dominion Government:—

OFFICE OF THE MINISTER OF JUSTICE,
OTTAWA, 13th October, 1892.

DEAR MR. BELL,—In reply to your letter of 11th inst., I beg to say that the application of the General Mining Association of Quebec has received a very favorable consideration, and that we will be prepared to recommend to Parliament that an appropriation of one thousand dollars be granted, in pursuance of the request.

Yours sincerely,
(Sgd.) JNO. S. D. THOMPSON.

MR. BELL stated that the American Institute of Mining Engineers, the Mining Society of Nova Scotia, the Asbestos Club, and other Canadian bodies, had been approached with a view to holding an International Conference at Montreal, and favorable responses had been received. The date suggested by Dr. Raymond, as favorable to a gathering of the members of the American Institute of Mining Engineers was the third Tuesday in February, but a few days later would not signify if the Council desired to hold the Convention at a later date. The idea was that the American Institute should hold its annual meeting as the guests of the Association, and that an International Convention should be held at the same time, at which Canadian mining laws, mining practice, and the mineral industries and resources of the Dominion might form the principal subjects of discussion. At the last meeting of the Institute, held in Ottawa, about one hundred ladies and gentlemen were present, but the time of the year then was a busy one, and there was a strong likelihood that the attendance of Americans would be much greater on this occasion. With a strong representation from the provinces there should not be less than 500 present in February.

MR. J. BURLEY SMITH was heartily in sympathy with the proposed Convention, but he thought that the Government of the Province of Quebec, having already received direct benefits from the last meeting of the Institute, should also be asked to contribute a grant. He proposed that the President (Hon. George Irvine, Quebec), the Vice-President (Mr. James King, M.P.P.), Col. Lucke and the Secretary be a deputation to wait on the Government respecting such an appropriation.

MR. A. W. STEVENSON, in seconding the motion, said he did not doubt that the City Council of Montreal would also do something for the visitors.

MR. R. G. LECKIE said he was pleased to hear that the Institute was coming again to Canada. Canadians attending the Institute's meetings in the States were always received with the greatest cordiality and hospitality. We should do everything possible to make the occasion a success.

DR. JOHNSON, on behalf of the University of McGill, said he had no doubt if the authorities were approached, suitable accommodation for meetings would be provided.

PROF. BOVEY referred to the Reception given last year in the Engineering Building to the Electrical Engineers. He thought that a similar entertainment might be given at considerably less cost.

After some further discussion, full powers were conferred on the Secretary to employ what help would be necessary to prepare a programme and make all arrangements. The following names were suggested as a Citizen's Reception Committee: Sir Donald Smith, M.P., Sir Joseph Hickson, Sir J. William Dawson, J. J. C. Curran, Q.C., M.P., Hon. Senator Murphy, Hon. G. A. Drummond, W. C. McDonald, R. B. Angus, Duncan McIntyre, Richard White, Hugh Graham, E. B. Greenshields, Robert Cowan, W. R. Elmenhurst, A. T. Paterson, J. H. R. Molson, John Kennedy, C.E., Mr. St. George, City Engineer, H. A. Budden, Hugh McLennan, Mr. Hannaford, Hon. Mr. Ogilvy, H. Beaugrand, D. L. Lockerby, C. Cassils, P. Redpath, Dr. Brainerd, Consul-Gen. Knapp, James Burnet, R. Blackwell, Jonathan Hodgson, Samuel Finlay, B. A. Peterson, H. R. Ives, F. C. Henshaw, Henry Bulmer, G. W. Eadie, Edgar MacDougald, Prof. Bovey, Frof. B. J. Harrington, W. A. Carlyle, R. McCall, and Dr. Johnson, with power to add to their number.

The Council then adjourned.

INTERNATIONAL MINING CONVENTION.

INTERVIEW WITH THE HON. E. J. FLYNN.

QUEBEC, 7TH NOVEMBER, 1892.

A deputation consisting of the Hon. George Irvine, Q.C., *President*, Mr. James King, M.P.P., *Vice-President*, and Mr. B. T. A. Bell, *Secretary*, had an interview with the Hon. E. J. Flynn, Commissioner of Crown Lands, at Quebec, on 7th November, with the object of securing a grant of one thousand dollars from the Quebec Government towards the proposed International Mining Convention, to be held under the auspices of the Association at Montreal in February. The Hon. Mr. Flynn promised to recommend the request to his Government.

EXTRAORDINARY GENERAL MEETING.

MONTREAL.

FRIDAY, 9TH DECEMBER, 1892.

On the call of the Council a Special Meeting of the Association was held in the office of the Treasurer, Mr. A. W. Stevenson, C.A., at 17 St. John Street, Montreal, on Friday, 9th December. There was a good attendance. Among others present were:

Mr. James King, M.P.P. (King Bros.), Quebec.
Mr. L. A. Klein (American Asbestos Co.), Black Lake.
Mr. John J. Penhale (United Asbestos Co.), Black Lake.
Mr. W. H. Jeffrey (Jeffrey's Asbestos Mine), Montreal.
Mr. S. P. Franchot (Emerald & Central Lake Mining Companies), Buckingham
Mr. J. Burley Smith (British Phosphate Co.), Glen Almond.
Mr. Hector McRae (Electric Mining Co.), Ottawa.
Mr. F. Cirkel (Templeton Asbestos Co.), Templeton.
Mr. J. Lainson Wills, F.C.S., Ottawa.
Mr. W. A. Allan (Little Rapids Mining Co.), Ottawa.
Mr. George R. Smith (Bell's Asbestos Co.), Thetford.
Mr. W. H. Irwin and R. T. Hopper (Anglo-Canadian Asbestos Co.), Montreal.
Mr. T. P. Bacon (New Rockland Slate Co.), Montreal.
Prof. C. H. McLeod, Secretary, Canadian Society of Civil Engineers, Montreal.
Prof. B. J. Harrington, McGill University, Montreal.
Mr. A. W. Stevenson, C.A., Montreal, Treasurer.
Mr. B. T. A. Bell, Ottawa, Secretary.
Col. Lucke (Beaver Asbestos Co.), Sherbrooke.

In the unavoidable absence of the Hon. George Irvine, Q.C., President, Mr. James King, M.P.P., Vice-President, was called to the chair.

THE TAX ON POWDER MAGAZINES.

THE SECRETARY having read the minutes of the previous meeting and the notice convening the members, explained that as several members of the Association had been served with notices threatening immediate execution of the law for non-payment of the $150 license tax on powder magazines in the province, it had been decided to call the members together to consider what steps should be taken. Some of the members had suggested testing the legality of the Act in the courts, while others were in favor of approaching the Government and asking for its abolition or amelioration.

MR. JAMES KING, M.P.P.—Our President, the Hon. George Irvine, Q.C., told me that the tax was legal and my Company paid it. So had many others.

MR. L. A. KLEIN—I do not think that the law was framed with the object of taxing mines, but rather as a safeguard for the proper storage of explosives in large cities like Montreal and Quebec. There was a clause in the Act which left the taxing of mines, quarries and railroad works within the discretion of the Lieutenant-Governor-in-Council. I would suggest that a deputation from the Association wait on the Government and point out the burdensome nature of the impost on an industry which deserved encouragement rather than restriction. The Government should be asked that the mining industry be exempted from the application of the tax.

MR. W. H. JEFFREY—The tax is unjust, and I will test it even if no one will assist me.

COL. LUCKE—I will assist you. I will not pay until I am compelled to.

MR. T. P. BACON—Our Company received a threatening letter from the collector, but after getting a legal opinion thought it best to pay up.

MR. W. H. IRWIN—There can be no doubt that the tax is a very onerous burden. He thought the better plan would be to see the Government and explain its hardship and if possible get it remedied. He would move the following resolution :—

"*Resolved:* That a deputation, to be nominated by the Chairman, wait upon the Quebec Government and lay before it the sense of this meeting regarding the imposition of the Powder Tax as applied to mines, with a view to inducing the Lieutenant-Governor-in-Council to exercise his right of exempting the mines of this Province, as provided for in the Powder Act, and that as an alternative the Government be requested to grant a case to test the legality of the Act."

MR. J. BURLEY SMITH—The tax is an iniquity which should be combatted. He would co-operate in a measure of resistance.

THE SECRETARY recommended a policy of conciliation. There was no use of "kicking against the pricks." That the Act was legal enough was shown by the opinion of their President, who was a member of the Government when it was framed, and it had been endorsed by many of the companies' solicitors who had been consulted regarding it. There could be no doubt of the injustice of the Act. It was a tax on industry. The Government might just as reasonably make an impost on their picks and shovels. To companies operating a number of pits on one property, and where the minimum quantity of powder stated by the Act was a necessity at all, the tax was practically prohibitive.

MR. IRWIN'S motion, having been seconded, was put to the meeting and carried.

THE CHAIRMAN then named the following deputation: L. A. Klein, Black Lake; J. Burley Smith, Glen Almond; S. P. Franchot, Buckingham; Col. Lucke, Sherbrooke; Hon. George Irvine, Q.C., Quebec; and James King, M.P.P., Quebec.

THE INTERNATIONAL MINING CONVENTION.

THE SECRETARY submitted the correspondence with reference to the meeting of the American Institute of Mining Engineers and the International Mining Convention, to be held in Montreal during the week beginning 21st February next. Dr. Raymond had intimated that so far 160 gentlemen and 69 ladies had signified their intention of being present. The Mining Society of Nova Scotia would attend in a body and hold a special session. The Dominion Government had voted $1000 towards expenses, and the Hon. E. J. Flynn had promised to recommend an application for a similar amount to the Quebec Government. The Mining Society of Nova Scotia would arrange its programme of papers and discussions, and Ontario would be represented by a committee consisting of Messrs. W. Hamilton Merritt, M.E., Toronto, (Chairman); A. Blue, Director of Mines, Toronto; Prof. C. Gordon Richardson, Toronto; T. D. Ledyard, Toronto; E. N. Rathbun, Deseronto; J. Bawden, Kingston, and G. Mickle, Sudbury. These gentlemen would, in conjunction with the Provincial Mining Association of that Province, formulate a programme that would represent the interests of Ontario. So far as he could note, the attendance from all sources would not be much short of 600. The Canadian Society of Civil Engineers had adjourned its annual meeting to the date of the Convention, so there would be meeting in Montreal at one time the greatest Convention of engineers ever held in this country. The list of papers promised was large and thoroughly representative of the interests of the country.

On motion Messrs. Stevenson, Irwin, Gardiner, Hopper and the Secretary, were named a committee to arrange a programme of entertainment for visiting members.

The Case of Capt. T. J. Watters.

The Secretary—I have been asked by a number of members to submit for consideration the question as to whether a Civil Servant should be debarred from investing his means in mining. As you all know, many Civil Servants in the employ of the Dominion Government are engaged indirectly in the operation of mines of phosphate and mica. As an instance, it is well known that Capt. T. J. Watters, an officer of the Customs Department at Ottawa, has invested heavily in establishing the mica mining industry in the County of Ottawa, on a scale that is highly creditable to the country. But the question has been raised that Capt. Watters has no right to invest his money in mining and is debarred by the Civil Service Act from engaging in any way in any enterprise beyond his official duties. Some of our members think that this application of the Civil Service Act is an injustice and would like it considered by the Association.

Mr. J. Burley Smith—I am strongly opposed to the policy of permitting a public servant using his time in a private enterprise.

Col. Lucke—As it is now dinner time, I beg to move the adjournment of the meeting. I hardly think Capt. Watters' case comes within the scope of this Association—it is a matter between Capt. Watters and the Government.

The meeting then adjourned.

COMPLIMENTARY DINNER TO MR. F. CIRKEL.

—

In the evening at half past seven o'clock, the members assembled at the Vienna Café to give a "send off" to their genial confrere, Mr. Cirkel, M.E., Manager of the Templeton Asbestos Company, who was about to leave for Europe. About twenty-five sat down at the table, including: A. W. Stevenson, C.A., Montreal; His Honor Judge Dugas, Montreal; J. N. Greenshields, Q.C., Montreal; Col. Lucke, Sherbrooke; L. A. Klein, Black Lake; W. A. Allan, Ottawa; J. Lainson Wills, Ottawa; A. Merrill, Templeton; George R. Smith, Black Lake; W. Bell, Montreal; S. P. Franchot, Buckingham; C. W. Morgan, Toronto; Hector McRae, Ottawa; John J. Penhale, Black Lake; F. P. Bacon, Montreal; J. Burley Smith, Glen Almond; R. Bond, Montreal; Robt. Gardiner, Montreal. Mr. A. W. Stevenson, Treasurer of the Association, presided, having on his right hand the guest of the evening, and on his left His Honor Judge Dugas. Mr. S. P. Franchot acted as croupier. After an excellent dinner and the usual loyal and patriotic toasts had been honored, the Chairman in a few graceful sentences, proposed the health of their good friend Mr. Cirkel, who was about to leave them for a short time. Although only a little over a year in their midst his geniality had won him hosts of friends, and he hoped that they would all see him back again early in the new year, invigorated by his trip for renewed activity in the mines. The toast was honored with three times three and a tiger, and "He's a jolly good fellow." Mr. Cirkel responded by briefly thanking the members for the honor they had done him. Since coming to Canada he had been treated with the greatest kindness. He could not find words sufficient to express all he would like to say, but with their permission he would rather play and sing something for their entertainment. Mr. Cirkel then delighted the company with a selection from his German songs. His Honor Judge Dugas followed with some particularly happy allusions to the subject of "The Law," and was succeeded by Mr. J. N. Greenshields, Q.C., who declared in a vigorous speech that it was the bounden duty of governments and parliaments to encourage in every possible manner the development of the great natural resources of the country. Too much money had been wasted, he said, on effete schemes to build railways where they were not required, and to promote other equally futile enterprises. Considerable humour was manifest in the capital speech of Mr. S. P. Franchot, while the drollery of the stories told by Mr. Hector McRae was inimitable. The remainder of the evening was pleasantly spent in song and sentiment, to which Messrs. W. Bell, George R. Smith, Col. Lucke, B. T. A. Bell and J. Lainson Wills contributed. The company separated at midnight.

THE TAX ON POWDER MAGAZINES.

INTERVIEW WITH THE HON. J. S. HALL.

QUEBEC, 11TH JANUARY, 1893.

On Wednesday, 11th January, 1893, a deputation consisting of the Hon. George Irvine, Q.C., *President*, Mr. James King, M.P.P., *Vice-President*, Mr. L. A. Klein, Mr. J. Burley Smith, Mr. R. T. Hopper, Mr. S. P. Franchot, and Mr. B. T. A. Bell, *Secretary*, had an interview at the Government Offices, Quebec, with the Hon. J. S. Hall, M P.P., Provincial Treasurer, anent the repeal of the present tax on powder magazines as applied to mines. After a good hearing had been given to the various speakers, the Hon. Mr. Hall promised to give the matter his careful consideration.

INTERNATIONAL MEETING.

MONTREAL.

21ST, 22ND, 23RD, 24TH, 25TH, FEBRUARY, 1893.

Under the auspices of the Association, there assembled in Montreal, during the week commencing 21st February, 1893, members of the American Institute of Mining Engineers, (who held their sixty-fourth meeting), the Mining Society of Nova Scotia, the Asbestos Club, and the Provincial Mining Association of Ontario. The official register of attendance was as follows:—

Adams, Capt. Robt. C., Anglo-Canadian Phosphate Co., Montreal.
Ayres, W. S., Civil and Mining Engineer, Kenvil, N.J.
Ayres, Mrs., Kenvil, N.J.
Allan, W. A., Little Rapids Mining Co., Ottawa.
Allison, Robt., Franklin Iron Works, Port Carbon, Pa.
Allison, Mrs., Port Carbon, Pa.
Adams, F. M., Adams & Davis, New York.
Archibald, Charles, Gowrie Coal Co., Cow Bay, C.B.
Archibald, the Misses, Cow Bay, C.B.
Archbold, James, Scranton, Pa.
Archbold, Mrs. and the Misses, Scranton, Pa.
Addie, G. K., Sherbrooke, Que.
Barnard, F. S., M.P., Victoria, B.C.
Barnard, Mrs. F. S., Victoria, B.C.
Barnes, Geo. T., Philadelphia, Pa.
Barnes, Mrs. G. T., Philadelphia, Pa.
Boyd, H. A., Buffalo, N.Y.
Bagg, Mrs. Dr., New York.
Blake, Theo. A., New York.
Blake, Wm. P., Schullsburg, Wis.
Blake, Miss C. H., New Haven, Conn.
Barnes, Edward, Sunderland, England.
Blue, A., Director of Mines, Toronto.
Buck, F. P., Dominion Lime Co., Sherbrooke.
Birkinbine, John, Philadelphia.
Bell, B. T. A., *Canadian Mining Review*, Ottawa.
Bell, James, Arnprior, Ont.
Bell, Dr. Robt., Geological Survey of Canada, Ottawa.
Bell, Mrs. Robt., Ottawa.
Burchall, Jas. T., Sydney Mines, C.B.
Burchall, Mrs., Sydney Mines, C.B.
Cleghorn, J. Raymond, Philadelphia, Pa.
Cleghorn, Miss Mabel, Philadelphia, Pa.
Cleghorn, Mr. Clarence, Philadelphia, Pa.
Cleghorn, Mrs. Clarence, Philadelphia, Pa.
Coleman, Prof. A. P., Toronto, Ont.
Carriere, C. H., Levis, Que.
Chown, Chas. D., Kingston.
Cirkel, F., Templeton Asbestos Co., Templeton, Que.
Cameron, Ian., Dominion Mineral Co., Sudbury, Ont.
Conyngham, J. N., Wilkesbarre, Pa.
Conyngham, Mrs. Wilkesbarre, Pa.

Conyngham, Col. C. M., Wilkesbarre, Pa.
Conyngham, Miss, Wilkesbarre, Pa.
De Camp, Mr. W. S., New York.
De Camp, Mrs. W. S., New York.
De Camp, Miss, New York.
Day, Dr. David T., Washington.
Day, Mrs. David T., Washington.
Day, Mrs. W. C., Sworthmore, Pa.
Dowling, D. B., Geological Survey, Ottawa.
Drummond, G. E., Canada Iron Furnace Co., Montreal.
Egleston, Prof. T., Columbia College, New York.
Eustis, W. E. C., Eustis Mining Co., Boston.
Evans, A. M., King Bros., Asbestos Mines, Black Lake, Que.
Ells, Dr. Robt., Geological Survey, Ottawa.
Fergie, Chas., Drummond Colliery, Westville, N.S.
Futvoye, I. B., St. John's, Que.
Fielding, Hon. W. S., Halifax, N.S.
Francklyn, G. E., General Mining Association of London, Hatifax, N.S.
Francklyn, Mrs., Halifax, N.S.
Fraser, Graham, New Glasgow Coal and Iron Co., New Glasgow, N.S.
Franchot, S. P., Emerald Phosphate Co., Buckingham.
Franchot, Mrs., Buckingham.
Faribault, E. R., Geological Survey, Ottawa.
Francis, Lewis W., Port Henry, N.Y.
Garrison, F. Lynwood, Philadelphia.
Gue, T. R., Acadia Powder Co., Halifax.
Garvin, J. M., Rock Run, Alabama.
Greene, W. H., Philadelphia.
Giroux, N. J., Geological Survey, Ottawa.
Howe, Dr. Henry M., Boston.
Howe, Mrs. H. M., Boston.
Hines, Samuel, Scranton, Pa.
Hines, Mrs. Samuel, Scranton, Pa.
Haycock, E. B., Ottawa, Ont.
Harris, O. M., Montreal.
Hammond, James B., Sudbury, Ont.
Hanson, E., Montreal.
Hooper, William B., Rambroyn, N.Y.
Higginson, T. S., Buckingham.
Hegeler, J. W., La Salle, Ill.
Hayes, C. Willard, Washington.
Hardman, J. E., Oldham, N.S.
Hopper, R. T., Montreal.
Halsey, F. A., Sherbrooke.
Halsey, Mrs. F. A., Sherbrooke.
Irvine, Hon. Geo., Q.C., Johnson's Co., Quebec.
Irwin, W. H., Anglo-Canadian Asbestos Co., Montreal.
Inman, A. L., Pittsburgh, P.A.
Inman, Wm. John, Plattsburgh, N.Y.
Jeffrey, W. H., Danville Asbestos Mines, Danville, Que.
Jones, John P., Iron Mountain, Mich.
Jones, Miss, Iron Mountain, Mich.
Johnson, C. S., Iron Mountain, Mich.
Johnson, Hon. Cecil, Harkness Hall, Scarboro', England.
Kirkwood, T. M., Sudbury.
Klein, L. A., American Asbestos Co., Black Lake, Que.
Kirchoff, C., New York.
Kirchoff, Miss Lindon, New York.
Kennedy, John S., New Glasgow Coal and Iron Co., Ferrona, N.S.
Leckie, R. G., Londonderry, N.S.
Leckie, Mrs. R. G., Londonderry, N.S.
Leckie, R. G. E., Torbrook, N.S.
Lyman, Frank, Brooklyn, N.Y.
Lennon, G. H., Sudbury.
Lindsley, Stewart, Orange, N.J.
Lehman, Ambrose E., Philadelphia.
Lynch, W. H., Kootenay, B.C.
Leonard, Gardner C., Albany, N.Y.
Lidgey, Hubert, Murray Mine, Sudbury, Ont.

Lowe, A. P., Geological Survey, Ottawa.
Leofred, A., Quebec.
Laine, D., Levis, Quebec.
Moore, W. B., Pictou Charcoal Iron Co., New Glasgow, N.S.
Montague, Thomas, New York.
Mickle, G. R., Sudbury, Ont.
Moen, Philip, Worcester, Mass.
Moen, Mrs., Worcester, Mass.
Morgan, C., Toronto.
Merritt, W. Hamilton, Toronto.
Medbury, Chas. F., Montreal.
MacIntosh, William, Buckingham.
Marcotte, J. A., Black Lake, Que.
Miller, J. B., Toronto.
Macdonald, Alex., St. John's, Que.
McKay, John, Sault Ste. Marie, Ont.
McConnell, Rinaldo, Mattawa, Ont.
McCormick, Henry, Harrisburg, Pa.
McCormick, Miss, Harrisburg, Pa.
McNaughton, James, Albany, N.Y.
McLennan, J. S., Dominion Coal Co., Boston.
McDougal, George, Crescent Gold Co., Malone, Ont.
McEvoy, Jas., Geological Survey, Ottawa.
McDuff, George, Waverley, N.S.
McInnes, Wm., Geological Survey, Ottawa.
McRae, Hector, Electric Mining Co., Ottawa.
McGuinness, Miss, Dunnville, Pa.
McGee, Chas., Bristol Iron Co., Ottawa.
Nason, H. B., Troy, N.Y.
Nicol, Prof., Kingston, Ont.
Obalski, J., Inspector of Mines, Quebec.
Pardee, J. P., Stanhope, N.J.
Pardee, Mrs., Stanhope, N.J.
Phillips, W. B., Engineering and Mining Journal, N.Y.
Penhale, Matthew, Glasgow and Montreal Asbestos Co., Black Lake, Que.
Penhale, John J., United Asbestos Co., Black Lake, Que.
Proudfoot, F., Winnipeg.
Pullman, J. W., Philadelphia.
Pullman, Mrs., Philadelphia.
Poole, H. S., Acadia Coal Co., Stellarton, N.S.
Pinolet, L. M., New York.
Purves, James C. H., North Sydney, C.B.
Papineau, J. M., Montreal.
Peters, Richard, Jr., Philadelphia, Pa.
Raymond, Dr. R. W., New York.
Rossi, A. J., New York.
Richards, Robt. H., Boston.
Ramsay, W. M., Montreal.
Robb, D. W., Amherst, N.S.
Richardson, Prof. C. G., Toronto.
Rutherford, W., Toronto.
Russell, Walter S., Detroit, Mich.
Reid, Hon. James, Quesnelle, B.C.
Robert, J. A., Montreal.
Stevenson, A. W. Montreal.
Scaife, W. L., Pittsburgh.
Smith, Prof. T. Guilford, Buffalo.
Smith, Mrs. T. G., Buffalo.
See, Horace, New York.
See, Mrs. Horace, New York.
Smith, George R., Bell's Asbestos Co., Thetford, Que.
Selwyn, Dr. A. R. C., Geological Survey, Ottawa.
Sprague, T. W., Boston.
Smock, J. C., Newton, N.J.
Smock, Mrs. J. C., Newton, N.J.
Smaill, Wm., Londonderry Iron Co., Londonderry, N.S.
Smith, J. Burley, British Phosphate Co., Glen Almond, Que.
Scott, George S., New York.
Sjostedt, E., Pictou Charcoal Iron Co., Bridgeville, N.S.
Spotswood, Geo. A., Kingston.
Struthers, W. D., Sudbury.
Swenzel, Miss, Scranton, Pa.
Taylor, Francis D., Montreal.
Torrey, H. C., New York.

Torrey, Mrs., New York.
Torrey, J. Gray, New Jersey.
Taylor, C. H., Montreal.
Taylor, Chas., Montreal.
Totdt, E. B., Albany, N.Y.
Totdt, Mrs. E. B., Albany, N.Y.
Tratman, E. E. Russell, New York.
Tyrell, J. B., Geological Survey, Ottawa.
Viele, Mrs. M. J., Plattsburgh, N.Y.
Watson, Thos., Montreal.
Winchell, Horace, Minneapolis.
Wiley, W. H., New York.
Williams, H. J., Beaver Asbestos Co., Thetford.
Williams, Capt. John, New Rockland, Que.
Wellman, S. T., Thurlow, Pa.
Wellman, Mrs. S. T., Thurlow, Pa.
Wylde, H. M., Halifax.
Woodhouse, Alfred, F.G.S., Halifax.
Woodworth, G. L., Belmont Iron Co., Marmora.
Wills, Mrs. J. Lainson, Ottawa.
Williams, H. H., Quebec.
Witterbee, F. S., Port Henry.
Williams, Oliver, Catasauqua, Pa.
Williams, Mrs. O., Catasauqua, Pa.

RECEPTION IN THE WINDSOR HALL.

Shortly after eight o'clock the Hon. George Irvine, Q.C., President of the Association, accompanied by His Worship the Hon. A Desjardins, Mayor of Montreal, took the platform. There were seated around him Mr. John Birkinbine, Philadelphia, President, and Dr. R. W. Raymond, Secretary, of the American Institute of Mining Engineers; Mr. A. Blue, Director of Mines for the Province of Ontario, Toronto; Mr. F. S. Barnard, M. P., Victoria, B.C.; Mr. Macdougall, M.P., Sydney, C.B.; Mr. J. Obalski, Inspector of Mines for the Province of Quebec; Capt. Robt. C. Adams, Vice-President General Mining Association of Quebec, Montreal; Messrs. W. H. Irwin and R. T. Hopper, Anglo-Canadian Asbestos Company, Montreal; Mr. A. W. Stevenson, Treasurer, and Mr. B. T. A. Bell, Secretary, General Mining Association of Quebec, and others. Altogether the attendance numbered about six hundred, including many ladies. The proceedings were enlivened by an excellent selection of music, given by the full band of the 1st Victoria Rifles.

HON. GEORGE IRVINE—Ladies and gentlemen: In connection with my duty as President of the General Mining Association of the Province of Quebec, to preside at this meeting, you will be glad and relieved to know that it is not part of that duty to make a speech. I have, however, the pleasure of being able to tell you that there are other gentlemen here who will give you much more sound talk and eloquence than I could offer. I regret very much to say that several prominent men, whom we expected would take part in this evening's programme, have for one reason or another been prevented from attending. His Excellency the Governor-General, who was to have addressed you has been unable, for reasons which he has explained to Mr. Bell, our Secretary, to come. The Lieutenant-Governor of Quebec, I am sorry to say on his own account and yours, is confined to his house through illiness. It might be well perhaps to read to you telegrams and letters of regret which have been received from the several gentlemen who were to have been with us, but were prevented. (He then read telegrams and letters of apology from His Excellency, Lord Stanley, His Honor the Lieutenant-Governor of Quebec, the Hon. T. Mayne Daly, Minister of the Interior, Ottawa, and the Hon. E. J. Flynn, Commissioner of Crown Lands, Quebec.)

We have therefore to forego the pleasure of listening to these gentlemen. I have on behalf of the General Mining Association of the Province of Quebec, to welcome in the most cordial manner the mining engineers and their ladies and friends from the United States and Canada who have come here to attend this Convention; and particularly the ladies, who have already I hear, softened by their loveliness and graciousness the heart of old King Frost himself. We hope that by our best endeavors you may be able to enjoy to a full extent your visit. We feel a desire to do this more particularly because of the fact that when our people have visited the United States they have invariably been received with the greatest cordiality, kindness and hospitality; and we would like to show them that that kindness has been appreciated. I have now much pleasure in calling upon his Worship the Mayor to address you.

MAYOR DESJARDINS—Ladies and Gentlemen: We have just heard the letters of regret read which have been received from the distinguished gentlemen who were to have been here; and I am sure that deplorable fact has given you much disappointment. The fact that I am called upon to replace in part such well known orators proves that you are to be still further disappointed. I must tell you that when Mr. Bell, the

Secretary of the Convention, invited me a few days ago to attend this opening, I felt he was paying me a great honor, but while I accepted, I did not know that it would be in the capacity of Mayor of Montreal that I would serve. For we in Montreal during the last few weeks have been in what I may call a condition of doubt. No one knew who was mayor. One day you would hear somebody say: "I am the mayor;" and the next day another voice would make a like assertion, and with equal confidence. And I myself, although I claimed also to be the mayor, was not altogether certain of the truth of the matter. However, I am here to-night, and I *am* the mayor.

And as such, ladies and gentlemen, allow me to say that we, the people of Montreal, are highly gratified at the choice which you have made in selecting this city of ours as the seat of the meetings of this great Convention. We welcome you cordially, and we hope that your stay with us will be pleasant, and that the people will show such interest in the labors which you are about to undertake, that you will carry home with you the most agreeable recollections of your sojourn amongst us. You will forgive, I am sure, the lamentable fact that the snow has prevented, by blocking the trains, so many of your delegates from being in time to attend here this evening; although they will have been spared the bad English of the Mayor of Montreal.

You will allow me, ladies and gentlemen, to first acquit myself of a certain duty, a pleasurable one, which is to first welcome the members of that veteran Institute of American Mining Engineers which has for the last 64 years been at work with so much fidelity and zeal, and has accomplished so much for the advancement of the science of mining. We desire to say to them that whatever may be the discord between the two countries, it shall never destroy for our part the good fellowship and social intercourse existing between us. Nothing shall destroy that brotherhood of literary, scientific and intelligent amity.

To the divers associations which have been created within the past few years in the different provinces of the Dominion, we extend with equal warmth a most cordial welcome. They have a large field before them. We have only at the beginning to realise the amount of wealth and resources the good Mother Nature has in store for us. We have only at the beginning to realize, and it can be seen with half an eye, what can be achieved if these resources are properly worked. But the field we know is in good hands. We know that we have active, scientific men who will do all they can, and are doing all they can, to teach Canadians how to work these resources; and such good examples have been given us by our neighbors, that I am sure we shall soon be able to follow in their footsteps.

The questions you will have to study, the lectures you will hear, will not leave much room, by the practical essence of their very nature, for the imagination's play nor the inspirations of poetry. But you are practical men, and you will know how to supplement the deficiency. You have brought with you poetry—not in books, but far better than that—in reality; the poetry of heaven and nature combined! And we welcome that element, that refining and inspiring element, that foundation of what is best in poetry, with—shall I say, even more cordiality and tenderness than we welcome you of the *steely* sex.

I trust sincerely that the ladies may thoroughly enjoy their visit. They have heard, doubtless, of the attractions of our winter; and no doubt they have already since their arrival experienced in a practical manner one of those attractions—the sting of Jack Frost. For Jack Frost is a true Canadian in the sense that he has a fine appreciation, after his own fashion, of what is lovely and charming and tender. However, though our climate is cold, we shall endeavor to show you that it has not the slightest effect upon our hearts, naturally warm; for they are not cold. We welcome you all; and we trust that when such another Convention is contemplated, the members may be able to look back upon this one, and say: "Why should we not go to Montreal?"

Mr. John Birkinbine, President of the American Institute of Mining Engineers, on being called upon by the Chairman to speak, begged to be excused in favor of Dr. Raymond, the Secretary of the American Institute, as he (Mr. Birkinbine) was down to deliver an address later on in the evening.

Dr. Raymomd—There is one part of my speech, Mr. Chairman, ladies and gentlemen, which I did not learn by heart; and that is to say that though there have been 64 meetings of the Institute, the latter is not, as the Mayor supposed, 64 years old. We should certainly grow old very fast in that way. I have been present at 61 meetings, and I cannot count the number of times I have been an officer of some sort in connection with the Institute. It is also my duty to explain that the

Institute is not a body having any local habitation whatever; for when we come to meet in Montreal, we do not come as a body of strangers; for the word "American," as applied to our societies, includes alike Canadians and those of the United States. Therefore, in coming to Montreal, we simply come, as it were, to our own. And, so from the beginning, we have known nothing at all about latitude, nor of that thing we hear so much about—the boundary line. I may be treading on delicate ground when I say "Boundary Line." But, after all, where angels have rushed in, I should not fear to tread. The Mayor of Montreal has hit what I consider to be the truth in this connection, and in all connections where we from both sides of the line come together. So as I have no political ambitions on either side of the line, I may be permitted to say a word or two.

I am going to say in the first place that I do not think that pleasant and agreeable neighbors must necessarily marry. If I had to marry everybody that I ardently admire, there would be an awful breaking up of domestic ties in the families of members of the Institute of Mining Engineers. I think people can live humanely and affectionately side by side without thinking always about pulling down the partition. If Uncle Sam had to marry, I should prefer to see him join hands with a rosy, pink and frost-cheeked girl of the North, rather than a dusky maiden of the Pacific; but it seems to me that if the United States and Canada were to become one, we—that is the United States—would then have as our nearest neighbor the North Pole; and I think that Canada would be a far more pleasant neighbor. Not that we should not consider all the domestic and internal questions of the future, as well as of the past. But, while speaking frankly, I may say that to me there is a higher view than this to take. For I, for one, would not tread upon those glorious distinctions which have enriched the past, and given us so many splendid memories. Standing upon this soil of Canada, I cannot forget the Lilies of France; nor can I forget what my countrymen owe to the sturdy Englishmen who crossed the sea, and won for us that liberty which we have always enjoyed at home. The Lilies of France, the Eagle of the Republic, the Cross of St. George, are all essential component parts of the historical, martial and national memories of America. And for my part I care very little—nay, I may say more—I pray to God that the meteor flag of England and the ensign of my country, whose stars bid welcome to the sunrise, may never stand opposed upon any battle field—nay, may never wave over any field of blood; but rather may blend and wax glorious together as the white and more glorious banner of peace and progress, and so set an example to the world. And in that splendid relationship we can move forward with serried ranks to a victory, unstained, irrevocable, magnificent, matchless; a victory that shall be celebrated by the glad thanksgivings of earth and blessed by the smile of a favoring heaven. (Loud applause.)

THE DEVELOPMENT OF TECHNICAL SOCIETIES.

Mr. JOHN BIRKINBINE, (Philadelphia)—Through the partiality of my fellow members, I have been able during seven years service on the Council of the American Institute of Mining Engineers, to note the development of technical societies, a subject which commends itself as an appropriate theme for presentation at the time when relinquishing the office of president, we meet in convention with Canadian technical societies. Our next assembly, called at Chicago, at the time fixed for an International Engineering Congress, offers additional reasons for the selection of the topic.

If subsequent statements appear to give to the American Institute of Mining Engineers greater prominence than other kindred organizations, they may be excused upon the ground of long association with and loyalty to its members, and to a personal knowledge of their work. Besides, data as to growth and development is more accessible, and at a meeting of the Institute, features connected with it may be considered as of greater immediate interest than those affecting other organizations.

The purpose of this address is, however, to use the records of the Institute, as indicating a similar development of other technical societies rather than to claim pre-eminence for any organization; the work of each must speak for it.

Before referring especially to technical societies, a few thoughts may be devoted to the general tendency to form associations at the present time. Organizations may have been formed and are active in every profession and also in all branches of labor, trade, industry, commerce, manufacture, science and art. A record giving a list of such associations or the aggregate membership would be startling, and show how a large percentage of the population of North America is connected with one or more of these, but the figures cannot be even approximated.

The class of associations representing national, state or local trade interests, such as Boards of Trade, Chambers of Commerce, etc., may be used as an illustration. A late report showing that in the United States, there are over 1,100 of these, of which thirty are of national character, and more represent the interest of a State, or of districts including portions of a group of States.

Existing organizations may be divided into many classes, some of which are for mutual benefit in controlling rates, hours or character of labor, or for adjusting compensation paid or received for labor and materials. Others provide stipends for members during sickness or for their families in case of death, and another group seek to control the services of persons entering certain lines of employment, or fix standards for determining the qualifications of such. The proceedings of many associations are carried on in secret, others are more or less open, some use extreme scrutiny as to membership, and other may be included in the class, "omnium gatherum."

In all these forms of organizations, there is some good; any union for mutual advancement commands esteem, but in a number of cases, the better element of the membership is hidden or over-ruled by selfish purposes controlling the administration of affairs to the disadvantage of the mutual or progressive features. Probably no better evidence can be offered of the power of a few men to control others, or of the blind obedience of the masses to arbitrary dictation by leaders, than is presented by some of the popular trade organizations.

The class, however, in which we are especially interested includes those institutes or societies where professional and business men, recognizing the value of the interchange of ideas, assemble to discuss problems and processes, and while no comparison of the relative merits of various forms of organizations will be made, it may not seem ungenerous or exhibit vanity, to claim for those whose primary objects are the investigation and discussion of subjects in which the members are interested, and the publication of the proceedings or transactions for the general advancement of a special trade or profession, as being in the foremost class of associations.

The number of different societies which may be properly in the special class mentioned, is greater than is generally believed; for, if from the list of all kinds of associations, there were eliminated the social or secret organizations, all others, which in any way attempt to affect or control the rates of wages or the hours or kinds of labor, or to fix or adjust prices for commodities, all strictly commercial organizations, and all those which offer any money benefit to members or their representatives, or those formed to advance certain sects, parties, nationalities, or classes, there will still be found a considerable number of organizations, representing constituencies of many thousands, joined together for the purpose of mutual advancement and for improving special professions or businesses in which the members are engaged, by the interchange of ideas, and dissemination of thoughtful papers and discussions.

Diversified business or professional interests encourage a considerable number of persons taking part in several associations, more or less closely allied, thus forming many powerful organizations of manufacturers engaged in special lines, and also of men following various professions. Thus, the legal fraternity presents a liberal contingent of associations representing that branch of professional work. Officers and members of various churches are formed into clubs, independent of synods, classes, assemblies, etc., and geologists, chemists, journalists, architects, artists, and engineers each have special organizations. It is to the last named group that attention is particularly invited.

Nearly twenty-two years have elapsed since the American Institute of Mining Engineers was organized, and its score of original membership has increased, the rolls now containing nearly 2,400 names, while the necrological data preserved in our records calls attention to the fact that over two hundred late members of the Institute have finished their earthly work and gone to their reward. In this list of the departed, are names of men who have done valiant service in the interests of mining and metallurgy, whose work lives and will live, and whose record is familiar, not only in their own, but in foreign countries.

Prior to the organization of the Institute, there was in the United States, but one national engineering society, and but few local organizations devoted to this profession, while the list of organizations in foreign countries was small. There are to-day in the United States four engineering societies of national character, with memberships as follows:—

American Society of Civil Engineers, organized 1865, membership of 1,650.

American Institute of Mining Engineers, organized 1871, membership 2,400.

American Society of Mechanical Engineers, organized 1880, membership 1,650.

American Institute Electrical Engineers, organized 1886, membership 650.

The scopes of these national associations vary to suit the purpose of organization, and the policy pursued in each differs from that of the others, being presumably adapted for the membership, which has in each extended beyond the limits of the United States, embracing many of the prominent engineers in Canada, Mexico, and in foreign countries.

Therefore, the engineering profession in the United States is well equipped with national associations, in which those interested in any particular branch, or who desire to follow a special line of enquiry, meet with others having similar purposes, for the reading of papers, or for the discussion of topics in which they are mutually interested; or if prevented from attending meetings, members can peruse the transactions as issued, from which information as to what has been presented and discussed is obtainable.

There are also national associations closely allied to engineering, which have obtained prominence and rendered much service to the members, or to the business represented, as well as to engineering; at the meetings of which papers are presented and discussed and publication made of matters of interest. Among such, are the associations of master mechanics, of railroad superintendents, car-wheel makers, car builders, founders, boiler makers and others.

To the national associations are to be added a score of local or district engineering societies or clubs, some of which have 500 names on the roll of members, possess excellent libraries, issue proceedings regularly and occupy commodious quarters in which the social intercourse of engineering is encourged, as an incentive to professional advancement.

The present meeting indicates that the Dominion is alive to the necessity of technical societies, for the Canadian Society of Civil Engineers, both by its membership (of 700) and its record is given a prominent place among engineering organizations, and the opportunity is cordially embraced of meeting with and learning of the General Mining Association of Quebec, the Mining Society of Nova Scotia, the Asbestos Club, and all other Canadian societies, who now meet in convention with the American Institute of Mining Engineers.

It is unnecessary to trace the history of foreign associations of engineers, beginning with the social club claimed to have been organized by Smeaton about 1771, nor to mention the number of associations devoted to engineering or kindred sciences, as given in the "Official Year Book of the Scientific and Learned Societies of Great Britain and Ireland." But in view of the courtesies which in late years have been exchanged between European and American engineers, the active interest in technical organizations in Europe will be recognized by reference to a few of the most powerful and well known societies.

The Institute of Civil Engineers of Great Britain reports a total of all classes of members exceeding 6,000.

The Societé des Ingénieurs Civils, France, has over 1,300 members.

The organization of Civil Engineers in the German Empire reports some 6,000 members on its roll, and the Mechanical Engineers have an association of about the same size.

The Iron and Steel Institute of Great Britain number 1,500.

The Verein Deutcher Eisenheutenleute has over 1,000 members. In addition there are societies in Russia, Sweden, Australia and, to us, other remote parts of the world.

It is expected that delegates from most of these associations will take part in the Engineering Congress at Chicago, in August next; an occasion which should do much to advance the fraternal feeling and the professional interests throughout the world.

The numerous technical and semi-technical societies mentioned, have not grown nor are they sustained merely by the social features they offer, pleasant as they may be; their formation was encouraged by a desire to interchange ideas, and they are maintained because of the benefit to be derived from the papers presented and discussed.

A past president of the British Iron and Steel Institute refers to the visit of that organization to the United States in 1890, with sentiments which may properly be employed to express the purpose and results of meetings which various associations have held and will hold in different portions of the world, and which may certainly be quoted on the present occasion :—

"These expeditions, through which we meet eye to eye, and voice to voice, our friendly competitors, to discuss the interests and the scientific aspects of the industry which absorb us, have been of great personal and national benefit. It is thus we learn how much has been accomplished by persistent and intelligent labor, how much remains to be achieved, and how by free exchange of ideas and of productions, friendly understanding is promoted and personal acquaintance is built up."

Those who have followed the growth of the American Institute of Mining Engineers, recognize its work in the contents of its transactions, but trace its influence, and that of kindred associations, in the advanced work in laboratories and engineering offices, in the growing appreciation of technical education, in improved methods of mining and metallurgy, and in a better understanding of geology, chemistry and other sciences.

Similarly much of the progress in applied science is directly traceable to other technical societies, and every branch of industry shows the good result of co-operation by those interested in special investigations

In reviewing the history of the Institute, it will be profitable to note the advances made in some special branches in which its members are directly interested; for the years covered by its life have been marked by great progress in the quantities of mineral won, metal produced and manufactured, and of a very great decline in the prices which the products of mine, furnace or factory command. Ample allowance may be made for the demands of a rapidly augmenting population, or for Governmental encouragement of industry, and yet the claim that a great part of this progress, both as represented by the increased production and decreased cost, is due to the development of technical societies, must be recognized. It is certain that in a number of known cases, men have been better equipped and better able to contend with the problems before them, because of their connection with technical societies, bringing to them the papers read and discussions had thereon, and much is undoubtedly due to close personal acquaintance and friendship resulting from association. A few facts selected from many which could be mentioned, illustrate the progress made during the existence of the American Institute of Mining Engineers, 1871-1893, and while the data presented refers to the United States, similar results, although possibly less pronounced in some cases, could be obtained for other countries.

The annual output of iron-ore has increased from three million to over sixteen million gross tons, making the United States the largest producer of this mineral, while for the past decade nearly a million tons of foreign iron ore per year found a market in the country. When the Institute was organized the Lake Superior iron district was producing slightly over eight hundred thousand tons of iron ore per annum, and had up to that time shipped an aggregate of four million tons; it has now reached an annual output of over nine million tons, and in the twenty-two years existence of the Institute it has furnished a total of seventy million gross tons. One and two-third million gross tons of pig iron (a) was the output of the blast furnaces of the United States, at the birth of the Institute, last year shows a total of over nine millions gross tons (b).

New districts have been opened, and sections which supported iron industries of but small capacity, have grown to be large producers. In the early days of this Society, the pig iron output was obtained from a number of small furnaces, and about one half was made with anthracite coal, three-tenths with bituminous coal and coke, and one-fifth with charcoal. Now three-quarters of the pig iron is produced with coke, the balance being divided into about the same proportion as in 1871, between anthracite and charcoal, but the quantities of each have been greatly increased, and owing to improved construction and methods, a smaller number of furnaces produce the larger quantity of pig iron.

The steel industry has in twenty-two years developed from an annual output of seventy thousand gross tons to one of four million gross tons (c). When the first meeting of the Institute was held, the Bessemer steel industry was making its initial impression on this continent, while open hearth steel manufacture was a struggling infant. The former has advanced from an annual output of thirty-five tons to one exceeding four

(a) 28 per cent. of what Great Britain then produced.

(b) A product of pig iron 20 per cent. greater than that of Great Britain in the same year.

(c) Bringing the United States in advance of the magnificent industry of Great Britain.

million tons (d), and while the latter has grown from three thousand tons to nearly six hundred thousand tons per annum (e).

In an interesting monograph, entitled "Twenty Years of Progress in the Manufacturing of Iron and Steel in the United States," Mr. James M. Swank says (f): "It seems almost incredible that as late as 1860 this country should have produced only 11,838 tons of all kinds of steel; yet these are the official government statistics. Our magnificent steel industry is virtually therefore the creation of the present generation." And yet with all these advances in the steel industry, with the displacement of iron rails by steel rails, the rolling of iron in all shapes has increased.

This inquiry might be carried further into the manufacture of rails, plate and bar iron and steel, nails, the construction of metal bridges, ships, locomotives, cars, machinery and the great works filled with superb appliances for fabricating them. But this is not the place for details, and further reference to the production of iron or steel will be confined to the statement that a ton of pig iron, of bar or plate iron, or a keg of nails, now sells at from 33 to 40 per cent. of what was received for it in 1871, while the price of steel rails is but 25 per cent. of what these commanded at the date mentioned.

In 1871 the greatest depth which had been reached in any of the copper mines of the Lake Superior region approximated 1,000 feet, and the price per pound for copper was thirty cents and upwards. It was then impracticable to work any of these mines which did not produce a mineral carrying 2 per cent. or more of copper. At the present time in that district, mines are 4,000 feet deep, and although copper sells for twelve cents per pound, mineral yielding six-tenths of one per cent. of copper is raised from a depth of 2,000 feet, crushed, jigged, delivered at refining works and sold at a moderate profit on the operation.

In the interval, the magnificent copper deposits of Montana and Arizona have been developed, the former taking first place as a producer, with the Lake Superior region second, and the total production of the United States of three hundred million pounds of copper, is now five times what it was in 1871. In addition the important discoveries and exploration of the copper and nickel deposits in the Sudbury district of

(d) A product nearly double that of Great Britain.
(e) This quantity is less than one half of the amount of open hearth steel made in Great Britain.
(f) Mineral resources of the United States, 1891.

Ontario, Canada, which have justly attracted widespread attention, deserve notice as factors materially influencing the output of copper.

The life of the Institute has seen the development of the heroic method of working gold gravels by hydraulic mining, and also its decline, owing to legislation prohibiting tailing into the streams of California, which reduced the output of gold some $10,000,000 per year. Although the hydraulic system was used in 1852, it was not until 1870 that the first large "inverted siphon" was introduced in the gold gravel section of California, and in 1876, the "deflector" was added to facilitate the handling of the "little giants." Under favorable conditions gold gravel has been treated by the hydraulic system for three cents per cubic yard.

In the treatment of gold ores by chlorination, advance has been made both in reducing the cost and working to a close extraction. Barrel chlorination has supplemented vat chlorination, late cost sheets showing favorable results.

The liberal introduction of vanners, and the consequent saving of the pyrites, which nearly always exist, may be cited as another important change.

Pan amalgamation for silver ore has improved and cheapened, and silver lixiviation has made important advances, while silver lead smelting has been greatly developed. In 1871 there were few smelting plants west of the Mississippi River. Now magnificent smelting plants are operated at Denver, Pueblo, Omaha, Salt Lake City, Leadville and elsewhere.

The so-called "practical" smelter has given way before the chemist and the experienced lead metallurgist. Cleaner and better work is now done, lower grade lead ores are utilized than formerly and lead slags made in 1878 are now being re-worked.

Direct matte smelting is another innovation, and while much has been done in concentration, this field is still very promising. In the time under discussion, the annual output of silver in the United States increased in value from $16,000,000 to $75,000,000

In a former address attention was drawn to the growth of the coal industry, it is only necessary therefore to refer to the distribution and the production of mineral fuel, increasing five-fold since 1871 and reaching an annual total of one hundred and fifty million tons, of which practically one-third is anthracite, and two-thirds bituminous, while in 1871 nearly equal portions of the two kinds of fuel were mined.

In the interval of time covered by the records of the Institute, power drills and high explosives have become necessities of mining, electricity has risen from a laboratory experiment, or a medium for operating telegraph lines to universal usefulness for light, and in many cases for power, and aluminum has entered the list of practically useful metals.

The above is a glimpse we obtain by looking backward, and if, as has been claimed, much of this progress mentioned may be properly credited to the influence of technical societies, a glance forward may be permissible, for the end is not yet, and further increase in the number, membership, and importance of technical associations may be expected.

Each society will in generous rivalry employ the best for securing the highest results to be derived from organization. In view of the past and recognizing that but a small proportion of those connected with any technical society can attend its meetings, the line of advance seems to be in the direction of maintaining a high standard for the transactions.

The purpose of meeting together is but partially fulfilled by the pleasures of personal intercourse, by warm welcomes and generous entertainment, by visits under advantageous conditions to industries or mines, and by the reading of papers ; for there is much profit in full discussion of many of the topics presented.

The discussions which should follow the presentation of most papers, make the contributions more valuable, and as a rule bring out information which the original does not contain. The papers are thus made more useful, not only by reason of these additions, but also because discussions upon the statements of the writers give to these greater weight. If statements are unchallenged in such discussions, the conclusions ordinarily reached would be that the premises upon which they were based are sound. On the other hand, discussions which might probably appear to challenge the data presented in papers do not, necessarily, condemn them, but may cause them to be so modified as to be of greater value than as originally presented.

There may be either the oral or written discussion. Some organizations follow the practice of printing papers in full prior to the meetings, and reading the papers in abstract, making the discussions the prominent features. Others have papers read in extenso, followed by oral debate, but the discussions are often less complete than is desired. The time allotted to sessions seldom permits of reading long papers, and allotting unlimited hours to the discussion, but in many contributions presented there are some features which need not, and others which should not be read in the sessions, as these would be tiresome if read in detail. Analyses, tables, statistics, etc., placed upon black-boards, issued in proof form, or exhibited by a diagram or by lantern slide, permit listeners to grasp them more readily and considerable time is saved.

A fair proportion of the papers presented before technical societies, are not such as to invite debate, but those offering points for discussion should be discussed, and if members who attend the meetings are prepared to respond promptly, confining the discussions within limited time and closely following the scheme of the papers, a large amount of valuable information can be imparted. The character and extent of discussions lies not with the officers of the organization, but with the members, and the subsequent value of the publication is likewise dependent upon the promptness and care which characterizes the revision of the subject matter, by individuals who participated.

Believing that future advances in technical societies will be influenced by the publication of well digested monographs, and by liberal encouragement of discussions upon the papers read, it seems to be better policy to print a small number of papers, fully discussed, than to merely issue a large amount of material offering controversial data without discussion.

Oral discussions offer the advantage of being more attractive and interesting to those attending meetings than the written discussion. The latter is generally more carefully prepared than the extemporaneous statements made when the members are in convention, but there are points often omitted in written discussion which would be brought out under the spur of personal contact, and members are less likely to take part in the written than in oral discussions.

The late Hon. James G. Blaine, writing on the growth of reports of Congressional debates, makes some interesting statements, and while these are quoted, the intention is not to intimate any close analogy between the Congressional debates and the business of the technical discussions which enliven the meetings of the organizations specified, but rather to advocate initial oral discussion, supplemented by written data.

Mr. Blaine says:—

"In the beginning of the Government, and for many years thereafter, on every important measure that came before Congress of the United States, on the expediency of which the members differed in opinion, there was an actual debate, in which positions were affirmed and contested with off-hand speech. In every conflict of this kind the members of Congress were, as a rule, in their seats, many taking part, and the mass so interested as to sit continuously through the debates."

After illustrating how the habit of speech has greatly changed and the general use of manuscript discussions read to many vacant chairs, extending in one house of Congress to giving permission to print speeches not one word of which has been delivered, Mr. Blaine mentions the Fiftieth Congress, which lasted from March 4th, 1887, to March 4th, 1889, and says:—

"In an uneventful period, with nothing specially to excite or disturb the country, the number of pages filled by the proceedings of a single Congress is greater than during the whole period of the Civil War, with all its mighty issues at stake."

To make a comprehensive and most suggestive comparison, he states that:—

"The Congressional reports for the last twenty-five years contained in volume of printed matter, 60 per cent. more than all the reports for the seventy-six from the inauguration of Washington in 1789 to the close of the Civil War in 1865."

It may be unfair to compare political debates and technical discussions, and the above is not introduced with any such object. The extracts are merely quoted to indicate the interest which attaches to oral discussion, drawing to the meetings members anxious to hear or participate, and eliciting a variety of opinions which would not be obtained under other circumstances. Such interest once excited may draw into the discussion persons who are not present, and thus gain the advantage of subsequent written discussions.

The papers presented at the meetings of technical societies and the discussions on these papers supply a record of progress, such as would be impracticable to obtain from any other source, and place in the libraries of members a fund of knowledge, which otherwise could only be secured by liberal personal outlays for expensive books. Without in any way detracting from the value and importance of works issued upon technical subjects, it may be safely asserted that it is impossible for special treatises to be as closely up to the times, as the transactions of technical societies, and thus each member of the various organizations can have an encyclopedia library as part compensation for his outlay in support of the society.

Another important influence exerted by papers and discussions is in the publicity given these by the trade and technical press. It has been claimed that members of engineering associations devote their energies to papers to be read before the technical societies which otherwise would be contributed directly to the technical press, but it is questionable whether in this particular the press at large is not the gainer, although possibly a limited number may lose special contributors; for the incentive to submit papers for criticism of fellow members increases the number of available contributors, and educates many to write for publication who would otherwise be silent.

My effort has been made to show the remarkable development of technical societies, giving some reasons therefor, and the claim has been made, which seems to be within reason, that the broader sentiment which has caused engineers to unite in associations, is responsible for a good share of the industrial advance which has been made. The thoughts as to the future increase and the most advantageous means of obtaining from these associations the full value which they offer, may be open to criticism, but they are presented after a careful review of the work of numerous engineering societies, backed by a personal knowledge of some most important results which have followed the presentation and the active discussion of papers presented. (Applause.)

On the conclusion of Mr. Birkinbine's address, the visiting delegates and their ladies were presented to His Worship the Mayor and Madame Desjardins; thereafter the floor was cleared and the remainder of the evening spent in an enjoyable impromptu dance.

PROCEEDINGS OF CONVENTION WEEK.

The following programme of meetings, excursions and entertainments was carried out under direction of the Council and members of the Association during the week:—

Wednesday—In the morning there was a session of the American Institute of Mining Engineers and the General Mining Association of Quebec. In the afternoon sessions of the American Institute of Mining Engineers and the Mining Society of Nova Scotia. These were held in the commodious and beautifully equipped new class rooms of the Physics Building, McGill University, kindly granted by courtesy of the Governors of the University. In the evening the visitors were driven to the Club Houses of the Montreal and St. George's Snowshoe Clubs, which were brilliantly illuminated, and where an enjoyable evening's entertainment was provided by courtesy of the officers and members.

Thursday morning—Session of the Institute. In the afternoon a united meeting of visiting delegates was held, the proceedings of which are reported in this volume. During the afternoon and evening various parties were entertained at the Toboggan Slides and Skating Rinks, while others attended the Hockey Match in the Crystal Rink. In the evening the session of the United Convention was continued.

Friday morning there was a special meeting of the General Mining Association of Quebec. The Ontario delegates also held a session. Both meetings took place in the Windsor Hotel. A large delegation was also present at the official opening of the new Engineering Buildings at McGill University, by His Excellency Lord Stanley; and the Luncheon which followed. On invitation of the Canadian Society of Civil Engineers a party of delegates participated in an excursion by train to the Victoria and Lachine bridges. In the afternoon parties were driven through the city and suburbs, visiting industrial establishments and points of interest. The evening was spent by many at a delightful skating Carnival given by the directors of the Victoria Skating Club, while others attended the Conversazioné given in honor of the opening of the new Engineering Buildings at McGill University.

Saturday—Excursion by special train to the works of the Canada Iron Furnace Co. at Radnor, Que.

THIRD ANNUAL MEETING.

MONTREAL.

WEDNESDAY, 22ND FEBRUARY, 1893.

The third Annual General Meeting of the Association was held in Lecture Room B, Physics Building, McGill University, on Wednesday, 22nd February, 1893.

The Hon. George Irvine, Q.C., *President*, in the chair.

After the presentation of the Treasurer's and Secretary's reports, which were unanimously adopted, the following Officers and Council were elected for the ensuing year:—

President:

HON. GEORGE IRVINE, Q.C., Quebec.

Vice-Presidents:

Capt. R. C. Adams, Montreal,
Mr. James King, M.P.P., Quebec,
Mr. John Blue, Capelton,
Mr. R. T. Hopper, Montreal.

Treasurer:

Mr. A. W. Stevenson, C.A., Montreal.

Secretary:

Mr. B. T. A. Bell, Ottawa.

Council:

Mr. L. A. Klein, Black Lake.
Mr. J. Burley Smith, Glen Almond.
Mr. George E. Drummond, Montreal.
Mr. F. P. Buck, Sherbrooke.
His Honor Judge Dugas, Montreal.
Mr. W. H. Irwin, Montreal.
Mr. John J. Penhale, Black Lake.
Col. Lucke, Sherbrooke.
Mr. S. P. Franchot, Buckingham.

The meeting then adjourned to meet on Friday 24th instant.

INTERNATIONAL MEETING.

MONTREAL.

THURSDAY, 23RD FEBRUARY, 1893.

On Thursday afternoon, 23rd February, a combined meeting of the delegates attending the Convention was held in Lecture Hall "A," of the new Physics Building, McGill University, to hear and discuss the papers presented by Canadian delegates. There was a large attendance, including members of the American Institute of Mining Engineers, the Mining Society of Nova Scotia, the Asbestos Club, the Provincial Mining Association of Ontario, the Canadian Society of Civil Engineers, and our own Association. Capt. Robert C. Adams, Vice-President of the General Mining Association, in the Chair.

The following papers were read at this and the evening session :—

THE MINING LAWS OF ONTARIO.

BY MR. A. BLUE, Director of Mines, Toronto.

For three-quarters of a century Ontario was known as Upper Canada. For two-thirds of that period it had a Legislature and Executive of its own, and for the rest of the time it was united with Lower Canada, now Quebec The union of the two provinces ended with June, 1867, and on the first day of July Upper Canada became a member of the new Confederation with the name which it now bears. Three years before this date the first statute regarding mines and mining was enacted by the Legislature of the United Provinces, having for its title "The Gold Mining Act." This and the Amendment Act of 1865, were the only statutes which dealt with mines and mining down to the date of Confederation; all other control was exercised under the authority of Orders-in-Council and by reservations in the patent from the Crown. Under the latter provision gold, silver, copper, tin, lead, iron and coal were so reserved down to the end of 1823, and gold and silver until the 13th of July, 1866, when a Regulation was approved by the Governor-

General-in-Council directing that in all letters patent for lands the clause reserving mines of gold and silver be omitted.

The necessity for exercise of Government control over mineral lands and mines arose in 1845, the first year of exploration and discovery on the north shore of Lake Superior. At first, each case requiring executive action was dealt with by Order-in-Council as it came up, but in the course of time certain principles were evolved to which general application was given under the form of Regulations. These, however, were changed six successive times within the space of one year, and after a seventh modification in January of 1847, they stood unaltered for nearly seven years. For license to occupy a location and open mines thereon, priority of discovery by exploration was a first requirement; but no license could issue until the explorer reported the result of his discoveries to the Government. It was also necessary that a scientific agent of the Government should have an opportunity to mark the boundaries of limits, determine the direction of boundary lines in the case of different courses of veins on adjoining locations, and examine the statements of exploration furnished by an applicant. Reports pointing out and selecting a location were classed according to receipt and held to be the best evidence of discovery; possession by the building and occupying of a hut was proof of the next value; while priority by application was assigned a third rank of value. The extent of a mining tract was first fixed at one mile in front by five miles in depth; but afterwards, in response to the petitions of explorers, the limit was extended to two miles in front by five in depth, the length to be with the course of the mineral vein. The land was sold in fee simple at eighty cents (4s.) per acre, $600 payable at the time of purchase, or when the certificate of location was issued, to cover the cost of surveying and other contingent expenses, and the balance in five yearly payments with interest. Upon these terms the lands on Lakes Huron and Superior were declared open for sale at the minimum price of four shillings per acre, in blocks of ten miles square; and although it was provided that all grants should be subject to such regulations to ensure the working of the mines as Parliament might thereafter enact, it does not appear that any conditions were required or imposed by that body.*

*The Mining Location ticket issued under the Rules and Regulations of the Orders-in-Council, of the 7th October and 2nd November, 1846, contained the condition that if the locatee should neglect to commence and *bona fide* carry on mining operations upon his location within the period of eighteen months from the date thereof, he should be held to have forfeited the location and license.

After a trial of seven years the Government became convinced that these Regulations were too burdensome upon the miners. The system of allotting mining tracts had not realized the anticipations formed of it; neither had it enabled individuals desirous of engaging in mining pursuits to effect their objects without compelling them to purchase locations of so extensive an area as to call for a needlessly large outlay on acquiring a right to explore and mine where the signs were favorable. Accordingly, in September, 1853, a new set of Regulations was introduced by Order-in-Council, applicable to Upper Canada only, under which the Commissioner of Crown Lands was empowered to issue to any person upon payment of \$100 (£25) a license to explore unceded lands in any county or section of the province (named or described in the license), for copper, lead, iron, tin, marble gypsum, earths or minerals. The license was to remain in force for two years, and the holder of it might take possession of a tract not exceeding 400 acres of unoccupied land, 40 chains front by 100 in depth, and "report his discovery and selection accurately by letter and map within six months from the issue of the license, accompanied by an affidavit made by himself and some other credible person proving that no counter occupation or workings exist." At the expiration of the term of two years the license-holder was required to complete a purchase of the tract selected by him at the rate of \$1.50 (7s. 6d.) per acre in one sum, or forfeit his right. It will be observed that these Regulations did not apply to gold and silver, unless they could be included under the general designation of minerals. In the next Regulations, adopted by Order-in-Council in March, 1861, gold and silver were specifically excluded, as doubtless it had been intended all along that they should come under the Regulations of 1845-47. The new regulations also abolished the fee of \$100 for permission to explore, and provided that locations be sold to the first applicant agreeing to the following conditions, viz: "That for mining purposes tracts comprising not more than 400 acres each be granted to parties applying for the same at the rate of \$1 per acre, to be paid in full on the sale," the applicant furnishing a plan and description of the locality to the Department of Crown Lands, "and on condition that such mineral location be worked within one year from the date of said grant." It was further provided that a patent should not issue until two years from the date of the purchase, and then only upon proof that the purchaser or his assignee had continued to work the location *bona fide* for at least one year previously.

In April of the following year working conditions were abandoned as to future sales, and it was agreed that patents should issue on the payment of the purchase money, but subject to a royalty of 2½ per cent. on ores raised or mined, payable on their value as prepared for market at the mine.

In March of 1864, the royalty of 2½ per cent. was changed to a tax or duty of $1 per ton on all ores except gold and silver, payable on removal from the mine, and this condition was made to apply to all mining lands sold under the Regulations of 1862. It was also provided by the amended Regulations of 1864, that not more than one tract of 400 acres should be sold to one person.

The new tax or duty remained in force only one year, a Regulation of April, 1865, directing that the clause requiring such payment should no longer be inserted in the grant or patent. The same regulation also authorised the Commissioner of Crown Lands at his discretion to omit the clause reserving mines of gold and silver in patents for lands on the shores of Lake Huron and Lake Superior.

The last of the Regulations for the sale of mineral lands by Order-in-Council were brought into operation in July, 1866, and dealt chiefly with ores of the base metals. They provided for the sale of mining tracts in unsurveyed territory in blocks of 200 or 400 acres; the survey of tracts at the cost of the applicant by a Provincial Land Surveyor; the furnishing of plans, field notes and descriptions showing the connection of a tract with some known point in previous surveys, so that it might be laid down in the office maps of the territory; and payment of the price of $1 per acre at the time of making application. These Regulations also provided that lands in unsurveyed territory should be sold by the Department and in surveyed townships by the local agents, and that in all letters patent for lands the clause reserving gold and silver be omitted.

In 1864 there was a rush of miners and prospectors to regions of Lower Canada, in which alluvial gold had been discovered, chiefly on the St. Francis and Chaudiere rivers and their head waters; and in that year, as already mentioned, the Legislature passed the first Act on the subject of Mines and Mining, known as "The Gold Mining Act." It was a statute of 40 sections, drawn up with much nicety and particularity for the mining of alluvial and quartz gold and the protection of miners' rights, for appointment of inspectors of divisions with large powers, for staking out claims of small areas, for licenses to mine, for licenses to mill, for sworn returns of gold taken out, for preservation of the peace, and, in short, all the trappings which the wit of legislators might devise for conserving the interests of the Crown and protecting the rights and fixing the obligations of miners in a placer diggings gold land.

The rush of miners and prospectors to the Chaudiere Valley was of short duration. Yet the Act of 1864 not only remained, with trifling amendments, the law of the country down to the end of the union of Upper and Lower Canada; it continued to be the law after Confederation, when the exclusive powers to make laws for management and sale of public land belonging to each Province was assigned to the Provincial Legislatures by the new Constitution, the British North America Act. A good reason for its continuance in Ontario was found in the discovery and working of veins of gold quartz in the County of Hastings, which had been set apart as a Mining Division under the Gold Mining Act on the 17th of November, 1866, ten days after the Commissioner of Crown Lands had received information of the discovery of gold in Madoc.

Under date of November 6, 1866, Hon. Billa Flint, of Belleville, wrote the following letter to the Commissioner:—

"My Dear Sir,—There is a great stir here at present about Gold in Madoc.

"Already one lot has been sold to Americans for about $30,000, and the gold is very rich; it also begins to be developed in other places in Madoc, than on lot 18, Con. 5.

"My object in writing is to say to you that I believe it exists in Elzevir, Hungerford and other townships, both east and west of Madoc, and my desire is to put you on your guard as to sales of land, as the people are going mad about lands for mining purposes.

"I have for years been satisfied that there was a vein of gold running somewhere about east and west across the Back Country, and have had several specimens from quartz rock for the past five years.

"I know geologists will not admit that we have mineral wealth, but I do know that they cannot tell where mineral is till we find it for them; and I have no faith in their statements, for when I have given Sir William Logan specimens he wont return them nor tell me what they are.

"The present excitement if kept up for a short time will bring our rocky land to high figures. Lands near this gold discovery that could have been got for $4 an acre, $10 is refused for them now; this shows the sanguine feeling of both holders and purchasers.

"So, if there is any good chance, of which I have no doubt, let the Government enjoy for the good of the whole country, the benefit by sale or leases.

"Yours, etc., etc.,

"BILLA FLINT."

Hon. A. Campbell,
Commissioner of Crown Lands,
Ottawa.

On this letter the Commissioner made a memorandum as follows:

"I have no faith in the gold being found in paying quantities; the Chaudiere country promised much greater riches, but the only persons who have made any money there have been speculators on the delusion of others in the price of lands, and the few who found gold in alluvial deposit. If there be any gold in the townships named by Mr. Flint it is *in situ*, and the expense of working it will be found to reduce the affair to the laws of ordinary industrial pursuits. The lands, however, in the townships named, should be treated as gold lands are in Chaudiere—sold at a price of $2 per acre cash, subject to Gold Mining Act.—A.C."

In the first session of the Legislature of Ontario after Confederation, the Act of 1864 was repealed, and one known as "The Gold and Silver Mining Act of 1868" was enacted in its stead,—provision for silver mining having been deemed necessary as a result of discoveries on the north shore of Lake Superior in the previous year. The new features of this Act related chiefly to the granting of licenses to explore and mine for gold and silver within the limits of a mining division and to the levying of royalties. Under the former Act a miner's license was of two kinds, viz., (1) a Crown Lands license, which upon payment of a fee of $2 per month authorized the holder to mine on any unsold public lands, and (2) a Private Lands license, which upon payment of a fee of $1 per month and after agreement with the proprietor authorized the holder to mine on any private lands within the limits of the division. Under the latter Act the fee for a license was reduced to $5 per year, and it authorized the holder to explore and mine for gold and silver upon any public lands in a division, but subject to the levy of a royalty of not less than two nor more than ten per cent. on the gross amount of gold or silver mined—the rate to be fixed by the Lieutenant-Governor in Council and variable for different mining divisions and different mines according to the yield. Proprietors of private lands were accorded the right to mine for gold and silver upon their own lands, subject to the royalty, and private licenses were abolished.

In the following year this Act was repealed, and there was passed in place of it "The General Mining Act of 1869," a measure which for the first time dealt by legislation with ores and minerals of all classes. It however retained most of the provisions of the former Act, applying them to the occupying and working of "mining claims" under miners' licenses when situate within any mining division, but abolishing the provisions relating to alluvial mines. Larger areas were designated as "mining locations," consisting of 80, 160 or 320 acres, the price was fixed at $1 per acre, and if the locations were in unsurveyed territory it was necessary to make a survey and file plans and descriptions as required by the Regulations of 1866. To a large extent, indeed, the old Regulations became in this measure crystallized into statutory law. By this Act, also, all royalties, taxes and duties reserved by any patent theretofore issued in respect of any ores or minerals weredeclared to be repealed and abandoned; all reservations of gold and silver mines contained in any previously issued patent were rescined and made void;* and it was provided that no reservation or exception of mines or minerals should thereafter be inserted in any patent from the Crown granting any lands sold as mining lands.

These general references to the Act of 1869 will suffice to exhibit the course of the development of mining legislation in our province; but I pass by the details and take up the law now in operation.

In the "Mines Act, 1892," the Act of 1869 and all subsequent Acts dealing with mining lands, mines and mining, have been consolidated and amended. It consists of four parts, viz.: general provisions, mining locations, mining claims and mining regulations, and for convenience it may best be considered under these several heads.

The administration of the mineral lands is presided over by the Commissioner of Crown Lands, and connected with the Department is a Bureau of Mines, established to aid in promoting the mining interests of the province. The Director of this Bureau acts under the instructions of the Commissioner, and is clothed with all the powers, rights and authority which an inspector or local agent may exercise in a mining division or locality, and such other powers as may be assigned to him by

*It has been stated that most of the patents issued down to the end of 1823 reserved for the Crown mines of copper, tin, lead, iron and coal, as well as of gold and silver; but inasmuch as only the two last named were by the Act of 1869 deemed to have passed with the lands to the owners in fee simple, it may be assumed that the right to the others in all cases where the reservation was made in the patent is still in the Crown.

regulation for carrying out the provisions of the Act. In practice the Bureau has charge of the mineral lands in surveyed territory (unsurveyed territory is in charge of the Department), and through it all correspondence and business relating to the selling, leasing and working of such land is carried on. It also publishes an annual report to furnish information on the mineral resources of the Province, the progress of mining and metallurgical operations, the condition of mines as regards the health and safety of miners and the observance of regulations for the employment of labor.

As in the original Act, any person may explore for mines or minerals on any unoccupied Crown lands, and such lands, if supposed to contain ores or minerals may be taken as mining locations or, if in a mining division, as mining claims. But lands so taken do not now carry the ores or minerals absolutely with the fee simple, as any acquired subsequently to the 4th day of May, 1891, are subject to a royalty for the use of the Province. It is an interest which the Crown reserves in mineral lands, and may be regarded as part of the price put upon them by the Act at the time of sale or lease. Accordingly no higher rate of royalty may be levied than is provided by the statute in force when the lands are granted. The royalties are in no case to be imposed or collected until after seven years from the date of the patent or lease (but extended in the case of original discovery to fifteen years), and then they are to be calculated upon the value of the ores or minerals at the pit's mouth less the actual cost of labor and explosives employed in raising them to the surface. In this way and under these conditions, silver, nickel and nickel and copper ores are subject to a royalty of three per cent., iron ore to two per cent., and all other ores to such royalty as may be imposed by Order-in-Council, not exceeding three per cent.

Mining locations are required to be of definite form and size, whether they are situated in unsurveyed territory or in townships surveyed into sections or lots. In the territory beyond Lakes Superior, Huron and Nipissing and the French and Mattawa rivers, wherein for the most part the great mineral-bearing formations of the province lie, each location in a surveyed township must consist of a half, a quarter, an eighth or a sixteenth of a section; and if in unsurveyed territory it must be of rectangular shape with outlines of astronomical bearings, containing 320, 160, 80 or 40 acres, surveyed at the cost of the applicants and connected with some known point in previous surveys, or with some other known point or boundary. The price of such locations ranges from $2.50 to $3.50 per acre, dependent on its distance from a railway and whether it is in surveyed or unsurveyed territory. For locations south of Lake Nipissing the price ranges from $2 to $2.50 per acre. Any greater sum, however, may be charged where a district or locality rich in mines or minerals has been set apart by regulation under Order-in-Council, or the land in such a locality may be temporarily withdrawn from sale.

The applicant for locations has the choice of obtaining a grant in fee simple at the price named above, or he may obtain a lease at $1 per acre for the first year and 25 cents per acre for each subsequent year, if the lands are in the territory north of the lakes; if south of the lakes the first year's rental is 60 cents per acre, and 15 cents thereafter. Leases are issued for a term of ten years with a right of renewal for a further like term at the same rental, if the conditions have been observed, and thereafter they may be renewed from time to time every twenty years at such rent as the regulations provide. But the lessee may at any time become the purchaser of the lands held by him, in which case the sum paid for the first year's rental is treated as part of the purchase money. This leasing system appears to be growing steadily in favor with mining men, and a large proportion of the lands now granted for mining purposes are granted under its provisions.

Whether a location is held in fee simple or by lease it is subject to certain working conditions, being an expenditure during the first seven years after the issue of the patent or lease in actual mining operations of $4 per acre where the area of the location exceeds 160 acres, and of $5 per acre where it is of less area; and such expenditure may consist of labor performed by grown men at the rate of $2.50 per day, or for explosives or other material for mining used on the location. In default of so much work by a *leaseholder* the lease becomes void and the location reverts to the Crown; in a case of default by an *owner*, all mines, mineral and mining rights so revert, but the owner retains all interests in the location as agricultural land.

Under the system of free grants to settlers adopted in 1868, all minerals have been reserved to the Crown, and by an amendment to the Public Lands Act in 1891, they are so reserved on all lands now sold for agricultural purposes. So it has come to pass respecting those lands that two classes of rights are recognized, viz.: surface rights and mining rights. The owner of the surface rights may apply for a patent or lease of the mining rights on his lot, and his claim possesses priority except where there has been an earlier application and a deposit of at least half the purchase price or rental made, or in case of original and *bona fide* discovery of valuable mineral by a subsequent applicant within one month prior to the application of the owner of surface rights. In either case the price per acre of a patent or lease is one-half of the rates for a mining location where surface and mining rights are not separated. But a prospector is limited in his right to go upon private land on which the minerals have been reserved to explore it. He cannot enter any portion of a lot used as a garden, orchard, vineyard nursery, plantation or pleasure ground, or upon which are crops that may be damaged by exploring, or on which is any house, church or cemetery, except with the written consent of the owner or locatee. Neither can the person to whom mining rights have been conveyed go on the land to open it for ores or minerals until he has first agreed with the owner of surface rights for compensation and damage; but should the parties fail to agree it is in the power of the Director of the Bureau of Mines to order and prescribe the manner in which compensation shall be ascertained and paid or secured, either by an arbitrator appointed by himself or by a suit or action in any county or district court between the parties.

It is to be observed that in all sales or leases of mining locations all pine trees thereon are reserved to the Crown, and should the locations lie within a timber limit the holder of a license to cut timber on the lands may enter upon them and cut and remove the trees. Yet although the patent or lease expressly reserves pine timber, the owner or lessee may cut and use all pine and other trees needed for building, fencing and fuel on the land, and for any purpose essential to working the mines upon it, as well as cut and dispose of all trees required to be removed in clearing the land for cultivation. But a lessee is restrained from using pine trees for fuel other than dry pine, and should he intend to clear any portion of the land for cultivation, he is required to give the holder of the timber license three months notice so that he may remove any pine on the area to be cleared. If at the end of that period it is not removed the lessee may cut and dispose of all trees on the land to be cleared, but subject to payment of the same dues as are payable by the holder of the license. The privileges of the lessee are also circumscribed in another particular. Should he during the first ten years seek to cut timber other than pine upon his location, beyond what is needed for building, fencing or fuel, or in the course of actual clearing for cultivation, or for any purpose essential to the working of the mines, he must first apply for leave to the Commissioner of Crown Lands, who may grant authority to cut the timber and fix the rate of dues to be paid upon it. But inasmuch as a lessee may forfeit and abandon his title to a location by the simple process of neglecting or refusing to prepay the yearly rent, it is not reasonable that he should be treated with the same liberality as an owner in respect to the timber upon the land. The important point is, however, that both owner and lessee of a mining location are entitled to the free use of all the timber upon it which may be wanted for mining purposes, while the owner is entitled to the free use of all timber, excepting pine, upon it for any purpose. The owner or lessee of mining or underground rights has of course no claim to use of the timber upon a location which, as far as it goes at all, goes with the surface rights.

The portion of the Act which relates to mining claims and the manner of acquiring, holding and working them is for the present inoperative, inasmuch as no tract of country has been declared or set apart as a mining division. The reason no doubt is that circumstances have not arisen to call for utilising the system for which it provides, either by reason of the distance of mining fields from surveyed or settled territory or the discovery of fields very rich in gold or other valuable ores where small areas would satisfy the desires of mining men. Mining locations are preferred, and there is not a demand for mining claims. Yet it is possible that the demand may arise in some portion of the vast mineral-bearing formations of the Province, and in view of that contingency it is well to have a provision ready at hand, to which effect may be given at the will of the Executive.

In the Mining Act of 1864, the area of a claim which might be staked out by one person holding a license was less than half an acre, and by a company of persons not more than about 2¾ acres, and these areas were doubled by the Act of 1869. The Mines Act 1892, provides for staking out by one person a claim 660 feet along a vein, by 330 feet on each side of it (about 10 acres), and by a company of persons a claim not exceeding at the maximum, 1320 feet along the vein by 330 feet on each side of it, (about twenty acres). But no person has the right to stake out a claim or to mine it who does not first obtain a miner's license, for which the fee is $5, and pay a year's rent for a claim at the rate of $1 per acre. A license is renewable only upon payment of the fee and of the annual rent for a claim, and the tenure of a claim depends, besides, on stringent working conditions. Adequate provision is made for the protection of miners' rights in a division, and for the enforcement of law and order under the authority of an Inspector.

The fourth part of the Act is chiefly designed to provide for the health, safety and well-being of miners through a proper and careful observance of Regulations for the working and management of mines; but as these follow pretty closely the British Mining Regulations, any enumeration of their features would be superfluous here. The Inspector whose duty it is to look after their enforcement finds that owners and officers of mines are, with rare exceptions, desirous of doing liberally all that the Regulations require, and it does not appear that the employed classes have a grievance under them for which legislation could effect a cure.

DISCUSSION.

Mr. McKay, (Sault Ste. Marie), said—The objections, in my mind, to the levying of a royalty are, first, that it is merely a means of furnishing a revenue to the province; and, second, that the bonuses and dues from pine limits will net the same amount to the province. Further, the price of mining lands at two and three dollars an acre for the portion of the province unsold would amount to about $150,000,000. From the standpoint of encouraging the development of the country, a high tax on land per acre would be preferable, as it would discourage the speculator and would not tax the company or individual in accordance with the development of the resources of the country. If a 3 per cent. royalty is not a high tax, we object to the Government singling out one specific industry to be the object of a direct tax. It is this fact that tends to discourage American or foreign capital to invest under the Ontario Mining Act; for the inventor who discovers a certain method of bringing together a certain material, for which he obtains from the Dominion Government, a patent, should be the object of a royalty as much as the explorer, who discovers the existence of mineral wealth. The inventor usually is paid by royalty, and it might be argued on the same lines as those which are urged on behalf of the royalty on minerals, that he should contribute to the province. Inventors would unanimously object to such a royalty being levied; and the answer of some manufacturers that he would not object to pay a 3 per cent. royalty on a good patent, does not dispose of the question any more than does the answer from one of our mine owners who operates under the old Act that he would not object to pay a royalty of 3 per cent. The royalty either comes out of the pocket of the explorer or the inventor; or out of the pocket of the capitalist, who uses the invention or the mine for the benefit of the public.

The mining industry requires every encouragement, and as the Royal Commission has said, the most legitimate means by which the people can really enrich themselves is by extracting the wealth from mother earth direct. The liquor traffic, in my opinion, out of which millions of dollars have been made by Canadians, should be made the object of additional taxation rather than mining.

PROF. C. G. RICHARDSON, Toronto—If I am not mistaken, the Act especially provides that this royalty is in lieu of all taxes?

MR. A. BLUE—Not in lieu of municipal taxes; and it is of course subject to the tax of one cent per acre, which the law imposes for local improvement purposes on lands which are not within municipal districts nor in incorporated townships.

PROF. C. G. RICHARDSON—With the principle of royalty, I have a great deal of sympathy. The only objection I take to the Mining Act of Ontario is in reference to the clause reserving from the miner the use of the green pine. This has caused a great deal of antagonism in the past between the miners and prospectors, and the holders of timber licenses. It is unfortunate that this should have occurred, since in very many instances fires have been set, no doubt wilfully, or at any rate, through carelessness, by prospectors when searching for minerals. The only way, so far as I can see, of securing immunity from danger in prospecting a wooded country, would be to make the interests of the prospector identical with the interests of the lumberman and the interests of the country; that is, in the preservation of the timber from fire. I think it would be well if the prospector could be assured of the pine.

MR. BLUE—Well, he is assured of that right for mining purposes.

PROF. RICHARDSON—Only to use it for building and clearing, not for roasting. Green pine for roasting is worth its weight in gold.

MR. BLUE—The question has never been raised. That is justified in the Act.

PROF. RICHARDSON—Green pine?

MR. BLUE—Well, I think so.

MR. IAN CAMERON, (Mgr. Dom. Mineral Co., Sudbury.)—I think the lumberman has got the right to use green and dry pine for his uses.

MR. BLUE—Under certain circumstances he has. Any location has the right to all timber upon it for any purpose; because most of the country up there is under timber limits. Timber limits have been disposed of here, and were disposed of before any minerals were discovered in the country.

MR. B. T. A. BELL—Doesn't the Mining Act make provision for inspection?

MR. BLUE—Yes; once or twice a year, or as often as may be necessary.

CAPT. PENHALE—I do not believe in the imposition of a royalty. I consider the Government should give greater encouragement to miners; for the minerals are of no use until they have been taken from the ground by the miner. I think the Government should remove every obstruction to mining. If they did, they would get more money out of the country, and would settle it rapidly.

MR. BELL—Capt. Penhale must not forget that up to the passing of the Act the mining legislation of Ontario was in a very bad state. The Government had sold lands for $1.00 and $2.00 an acre, and the result was that very large tracts of these valuable lands were locked up, and are locked up to-day, by speculators who hold them at large figures practically prohibitive to the development of mining. The Government is quite right in asking a fair price for lands. The idea of giving away valuable mineral land for $1.00 and $2.00 an acre without any condition as to its development was absurd. I think that while the Ontario laws may in some particulars require revision, they are in the main fair and equitable.

CAPT. ADAMS—It is important to notice that a feature of the present mining law is that no royalty will be levied on an industry for seven years, which gives a new industry a chance to establish itself. I think most mining men will agree that if any industry lives for seven years it ought to be in a pretty healthy state. I think that it is an admirable feature.

MR. IAN CAMERON, (Mgr. Dom. Mineral Co., Sudbury.)—I may say that we have no objection whatever to pay the Government a 3 per cent. royalty if the mine can afford to do so. I think the Government is quite justified in selling its lands at any price it may see fit to put on them. If it chooses to sell lands at $3.00 or $3.50 an acre and say: "after seven years you shall pay a 3 per cent. royalty of the net profits of the mine," it is in my opinion perfectly fair. The State ought to have the royalties. I may say that in the last twelve months I have been asked by some six or eight people if my company would buy properties, and have been asked to pay from $20.00 to $1,000 an acre, and above that a royalty at from 25 to 50 cents a ton. I see no reason for the grumbling about a 3 per cent royalty. It is a bagatelle.

DR. SELWYN, Director Geological Survey.—In my opinion a tax should be put upon the transfer of mining properties. In very many instances lands have been bought for one and two dollars an acre, and the owners have afterwards sold them for $150.00 to $200.00 an acre; and these men, after making a large deal, simply walked off with their money in their pockets. So, where a man sells his claim in that way for $50,000 or $100,000, he should be made to pay a tax to the Government. Besides, very often those men retain an interest in the properties they dispose of.

MR. J. BURLEY SMITH, Glen Almond, Que.—I would ask if it is a fact that when the Government grants a mining right, it is done with the idea or intention that the property shall be mined? Otherwise, they could not expect to derive a revenue from the royalty on that mine. If the Government leases lands to people who do not work them, it is quite evident that the law itself is inoperative; but a way to get over that, would be to make a miner take so much land on mining rights conditionally that he should work it, and make him also pay a certain sum for a certain number of years. The miner then knows that if he does not work the land it will not pay him to take it.

MR. R. G. LECKIE, Londonderry, N.S.—The Government is willing to dispose of its property at so much per acre. They will take no responsibility in exploring or developing these lands. It leaves that entirely to the purchaser. For instance, I have taken up several square miles of land in Nova Scotia, supposed to be inlaid with coal. We have spent probably fifteen or sixteen thousand dollars upon these lands. The coal supposed to exist here has not been found, and that money invested has practically been lost. The Government will not refund us anything; then we go on again, and purchase or lease other lands; and repeat perhaps, the same thing. If we are not successful, we lose our money; and if successful we ought certainly to have the return sufficient to cover the great risk we run of losing our capital. The Government will risk nothing; but leaves all the expenditure and risk of loss to the miners, or "adventurers," which is the English term.

NOTES ON THE LEGISLATION AFFECTING THE WORKING AND REGULATION OF MINES IN NOVA SCOTIA.

BY MR. H. S. POOLE, M.A., F.G.S., Stellarton.

In Nova Scotia the Provincial Legislature has besides the public weal the interest of a landlord in the minerals to influence the tenor of its Statutes relating to mining. These two interests have had added to them a third, which is political.

The earlier legislation had in view almost exclusively the extension of the industry and the encouragement of capitalists to develop the mineral resources of the province; this is especially noticeable in the debates of 1866, when members on both sides of the house unanimously agreed for these express purposes to grant to lessees the right to have their leases renewed on the same terms, conditions and covenants as contained therein for four periods of twenty years each. The form of lease adopted approximated closely to one very generally employed in Great Britain, and reserved to the landlord the right to inspect the mines and to object to bad practice. This reservation was in conformity with the Mines and Minerals Act which expressed alone, until the year 1873, the desire of the country to foster mining and to control the methods and practices of the miner.

This Act went on to define the terms under which mines and leases of areas could be held and the fees to be paid. A discussion of its requirements and the modifications that have been made to it of late is left to others. Here it is proposed to alone consider the practical branch, which in the Act in question was limited in Section 5 to the appointment of an Inspector and empowering him to examine and report to the Commissioner of Mines. It imposed but one penalty, forfeiture of lease, for all shortcomings on the part of the lessee, be they great or small; the result was that the Inspector of Mines was practically powerless to enforce any rules that good practice elsewhere commended. The writer realized this in 1872 on his appointment to the office of Inspector, and he then recommended that an Act based on the lately amended English Mines Regulation Act should be introduced, and one somewhat less stringent was with slight amendments passed the following year.

The desirability of such a Regulation Act appeared to be accentuated by the Drummond explosion, with a loss of 59 lives which followed almost immediately and before the Act came into operation. Its stipulations were almost exclusively in favor of life. It began by including all openings for mining purposes as subject to its provisions and then in provisoes made certain exemptions. It divided mines into two sections, metallic and non-metallic:

It defined who were responsible for carrying out its provisions:

It regulated the employment of boys:

It touched on the Check-weighman question:

It required two outlets fitted for the passage of men:

It stipulated for official returns, frequent surveys and reports of accidents:

It empowered inspection:

It provided for Coroner's inquests:

It laid down the well known General Rules:

It furnished a means for supplementing these by Special Rules:

And it imposed penalties for non-compliance.

The original form remained unchanged for many years and the first amendment of moment had to do with the restriction of operations under the landwash. This was felt necessary in view of the very large mileage of workable coal that lay off the foreshore of Cape Breton and which can only be ultimately won by reserving access thereto.

When in 1880 the Foord pit explosion with a loss of 43 lives followed an irruption of water which occasioned the loss of other six seemed to call for further legislation, amendments looking to making inquisitions more searching if possible than before were introduced, at the same time the foundation was laid for more frequent inspections, which it may here be mentioned have developed into regular monthly inspections by deputies; the office of Head Inspector being merged with that of Deputy Commissioner of Public Works and Mines, an office which alone carries with it a multiplicity of duties.

Authority was also given for the establishment of a Board of Examiners and the granting of certificates of competency to underground officials.* This portion of the Act has been since then expanded, mining schools have been established, and facilities furnished in each coal district for aspiring young men to more readily acquire the theoretical knowledge demanded at the examinations. The full benefit expected to result from this step has not yet been felt, the present state being rather one of transition, but the ultimate advantage of having even a rudimentary theoretical knowledge added to the practical work of coal mining cannot be doubted, and the benefits are already most marked.

A minor evil incident to a transition stage is experienced in the tendency of those holding certificates to regard them as credentials of special fitness. This is of course a mistake, a certificate is no guarantee that the holder is a man of tact, of common sense, of resource, is capable of directing men, or is in short a good pitman; all it does is to certify that the holder has actually had some practical experience, and possesses some of the qualifications that are desirable for one engaged in the management of a pit. In time however this difficulty should cease and a sufficiently large number of certificated men be available, from among whom selections may be made of those possessing, besides a certificate, the more valuable practical qualifications essential to a

* Chap. v., 1881.

successful pit manager. In this connection remarks last year by Mr. McKay, Supervisor of Schools, Halifax, on "School Preparation for Industrial Pursuits" are worth repeating:

"Of one hundred pupils who enter our common schools," said Mr. McKay, "only 33 per cent, complete the sixth grade and 20 per cent. the eighth grade. Nine per cent. enter the academy and four per cent. remain three years. Of ten who enter the academy, one matriculates into college with a view to one or other of the learned professions. The other nine leave with a more positive dislike for manual work than when they left the common school. Some of them will therefore teach, and others will become clerks, bookkeepers, etc. Why should education forces and government aid be so largely expended in preparing the few in Latin, so as to enable them to matriculate in medicine, law or teaching, while agriculturists comprising 45 per cent., or the working classes, are left ignorant of the fundamental principles of chemistry, botany and the use of tools? Why are artisans, comprising 28 per cent., left without a knowledge of industrial drawing? These subjects are not only of more importance to these classes than Latin is to professional men but also of more practical utility to all classes; and at the same time, in the opinion of educational reformers, better adapted as educational instruments for mental discipline."

Mr. McKay then went on to consider what constituted the best school preparation for industrial pursuits. Seven things, he thought, were necessary: "A thorough Kindergarten training; a sound physical education, good health and muscle; a knowledge of reading, writing and arithmetic; a knowledge of history and economics; a knowledge of the physical, chemical, and physiological forces of the material world; drawing; and manual training." In concluding he reminded his hearers that the literary classes had so far directed education, the industrial classes would do so hereafter.

But to return to our legislation, the intention of the numerous amendments following those of 1881 which related to raising the standard of official knowledge was obviously good, but we as a people have a very general belief that in legislation lies the panacea for almost every ill, and hence it is not uncommon to find Acts drafted by those untrained in legal phraseology and with limited experience, though evidently well meaning, accepted and as freely passed by the Legislature. The statute book is full of Acts hastily prepared and revised in the same laudable spirit, it may be even amended by two and sometimes three separate Acts during the same session. The various attempts to straighten out the clauses relating to certificated officials and their duties are cases in point.

First, the Act of 1881 stated that after a fixed time it shall not be lawful for any one not having a certificate of competency to be employed at any mine in this Province. The time was subsequently fixed for January 1st, 1884, but although there was the Act applying to all mines, gold, coal and iron, and, strictly read, to all workers in mines, boys and men without exception, no attempt was made to enforce this law. Again there remained for years on the statute book, clause 44, ostensibly framed to reduce the numbers of certificated officials in mines of limited extent, but which actually added to the number of officials required for the class it was intended to relieve, by being made to read "but the operations below ground shall be under the charge of persons holding certificates as underground managers and over-men." Strictly enforced, this, in some cases, would have required four officials at least to supervise the operations of even as few as two working men.

When representations have been made by those whose liberty of action was threatened to be restricted in consequence of the Act bearing a construction beyond that intended, the answer has been good naturedly made, "the intention is evidently otherwise, and an amendment *next* session can correct the ambiguity."

Or again, on complaints that important alterations have been made to the Mining Acts without those chiefly affected having an opportunity of studying their bearing prior to their passage through the House, they have called forth the remark, "Oh, the Government cannot prevent any member of the House from bringing in an amendment to any Act." This may be generally true, but as there is a special department devoted to mining matters under the direction of a member of the Government, it has been urged, and it is thought fairly, that all Acts and amendments relating to mines should invariably be Government measures. Not only so, but that no Act should be sprung on the mining community toward the close of a session when it is impossible to carefully consider it, but rather that all Acts relating to mines should be prepared during recess and be subject to the criticism of all classes likely to be affected by them.

The Department of Mines has experienced officers capable of weighing the advantages expected to be gained by any additional legislation, putting on the one hand the restrictions to be imposed and on the other the possible cost to the industry, and the attitude of this Department towards any proposed legislation should be clearly established, as is understood to be the case in England.

The strong faith in the efficacy of the mere passage of legislation leads to the assumption that when an amendment to the mining law is proposed it is evidence of its necessity, and our legislators are apt to consider the opposition of mining men to be expected and rather indicative of the necessity than otherwise for the additional restriction. They, therefore, say let us give the bill a trial, and if it doesn't suit why we can repeal it. As a seafaring people we know the benefit derived from the law requiring masters and mates to hold certificates—let us apply it to our mines as is done in other countries, and not only require the head pitman to hold a certificate, but let us go further and include all deputies, gas triers, shot firers, and even drivers of hoisting engines. This has been done, but the possible combination of circumstances and conditions has not been carefully worked out and made clear in the Act. In its present form, the Act suggests several questions on the intention respecting officials. How many offices can one man fill? Does a certificate of higher grade legalize the holder to perform the offices appertaining to a lower?

Again, whether the object of the Act is solely to ensure the employment of suitable men or has it in view to find employment for the greatest number of officials. This question arises when an attempt is made to follow the law in a small mine where the full train of colliery officials contemplated by the Act does not seem warranted. The list of officials besides the owner and agent reads as follows: manager, underground manager, overman, night examiner and shot firer.

It is a grave question whether the advantages expected to accrue from certificating shot firers and firemen such as gas triers and night examiners, are not more than met by the disadvantages and complications to which the law in its present shape gives rise, and the infractions of the letter of the law when temporary substitutes have unavoidably to be made of non-certificated men. In making appointments for these offices who can know the fitness of men so well as the mine managers?

A Board of Examiners certainly cannot. Take the case of a shot firer who must not only know the law relating to firing shots and the use of explosives underground about which he can be examined, but he must know the coal in which the shots are to be fired, how best the shots should be placed, and whether the pickman has "properly worked" the coal for the proposed shot. Especially must he have backbone enough to refuse to fire it when the conditions are not favourable. To judge of this fitness personal knowledge is essential, not mere acquaintance but knowledge of a man at his work, and who has that so well as the manager of the mine? And yet under the law the selection is no longer entrusted to this official, of all men the most interested in the appointment of fit persons, but it is subject to the approval of whom? Not even of a Board of Examiners for there is no written examination, but of a local miner, who may not be the holder of an underground manager's certificate of competency.

That this was intentional when the Act was framed is not for a moment suspected and yet it is the result when the law comes to be put in operation. It goes without saying that the management of a mine will appoint the best available men to the permanent positions and the best men for substitutes when such are required. Then again for such an occupation as driving an engine, book learning it has been contended does not add to the efficiency of a man, if anything rather the reverse, as it leads to abstraction and inattention to immediate surroundings. And it may be doubted if in this particular case the stipulation requiring a certificate is worth the annoyance it may at times occasion; at any rate in its present form, as no provision has been made for the temporary substitution of uncertificated men during the unavoidable absence of the regular drivers.

One anomaly connected with the law respecting the certification of officials having to do with mines has yet to be mentioned. In the Statutes of 1885 it was required that future Deputy Inspectors of Mines should be holders of certificates to be granted subsequently to examination, but this clause was on a later revision thought to be a mistake and deleted.

Then it would seem, so confident are we in Nova Scotia that the mining world outside our own, which is almost insular, can teach us no new thing, that our legislature has felt justified in emphasizing this feeling and guarding our interests from possible inferior practice and talent, by debarring any one however eminent he may be in his own country from practising here as a Colliery Manager, that is at least, until he has ripened his foreign experience by a three years' course with us and obtained a certificate from our Local Board of Examiners.* An exclusiveness that in some branches of trade and art has not elsewhere always led to the most rapid development of a country or the most happy results.

Attention may also be directed to the fatherly regard for colliery boys under 16 years of age, employed not only underground but above ground. No objection can fairly be taken to the restriction of the hours of labor below when the work is regular, but as the occupations of boys about a colliery above ground are healthy, far more so than those in close factories, and certainly not less so than those about metallic mines, in all cases exempted from the provisions of the law, it has been urged that to be consistent the hours of labor of boys in factories and other industries should be also restricted. Until this is done the purity of the sentiment that induced the addition of this clause must be questioned. At the present time it is exceptional to find one among the workmen who is in favor of restricting, especially on the surface, the hours of boys between fourteen and sixteen years of age to 54 hours a week.

It is of course very desirable that the apparent contradictions in the Act should, as far as possible, be eliminated, not an easy thing to do even when the interested parties are agreed, and still less so when there is disagreement and amendments are compromises. Among the changes that might be made, it is desirable that small mines and simply worked mines should not be obliged to employ a greater number of officials than the necessities of each case require, and which would be demanded were it not for the wording of the Act. And that the exceptional requirements of more complex mines should be met by additions to the Special Rules as provided by the Act.

It seems desirable that the law should clearly legalize the practice of the manager and the underground manager being one when the duties of the offices can be assumed by one person, especially as the definition of the duties attending these two offices draws a distinction with a difference that has yet to be legally defined.

* But an English certificate is accepted in lieu of local experience, still the holder must undergo a local examination.

It might be well if the definition of "overman" were changed and made to read the officer in charge in the absence of the underground manager.

And it would appear more consistent on the part of the Legislature if, for the welfare of the working man he is when engaged at the coal mine to be paid fortnightly, that he should be equally protected as regards the payment of wages when working for large employers of labor.

I bring forward these notes with the hope that by bringing them to the attention of our own legislature, amendments may be produced. I thought it better to take the bull by the horns, to discover whether we are likely to get this legislation or not, and therefore, the Mining Society of Nova Scotia expressed its desire that a representative of the Department of Mines or the Government might attend at this Convention. The Inspector was unable to be present, owing to pressure of business; but the Premier of our province having occasion to come to this part of the world at this time, has most kindly undertaken to appear on this occasion and to profit by this discussion, which it is hoped will take place on this and other matters. Those who know our silver-tongued orator can appreciate how venturesome it is of me to speak in his presence, as any one who has passed through the fire of Moloch, in the County of Pictou, can testify.

DISCUSSION.

CAPT. ADAMS—I think that Mr. Poole's able exposition and representation will tend to make us all good anarchists. I have much pleasure in calling upon the Hon. Mr. Fielding to address the meeting.

HON. MR. FIELDING—I have the pleasure of knowing a number of the gentlemen present this afternoon, and I trust that they know me well enough to feel that I do not presume to enter upon a discussion of mining laws in the midst of a body of mining gentlemen, the most of whom are ever disposed to think that all mining laws are bad. Far from finding fault with, I welcome Mr. Poole's criticisms most cordially. I congratulate him heartily, and join in expressing my regret that Dr. Gilpin, our Inspector of Mines, has not been able to attend. I do not wish for a moment any one to assume that I am present as a substitute or as a representative of the Government, in any capacity, to discuss mining matters. I had occasion to come this way, and combining pleasure with my business, I accepted the invitation to attend this Convention; and as the Mayor of Montreal said the other evening, "I am here."

There is a general tendency to grow in this world; and I admit that the laws of some years ago are not good laws now. If we are never to have any changes in these matters, I should get along very well; but the public at large seem to think that some legislation is necessary; and naturally we revise these laws when revision is considered essential; though sometimes we do not make them any better than they were before. But the public require that they should be revised all the same.

There is no province in the Dominion in which the mining community have received fairer consideration than the Province of Nova Scotia. We must deal with the truth that in former years laws were moulded at the will of the mine owners; but at the present time there is a disposition to recognize that there are more than mine owners to be considered in this matter, and we must speak plainly now. The working-men in the country have in the past few years made their voice heard and felt in the legislation of Nova Scotia; just as in the legislature of the civilized world; and in the desire to meet their reasonable wishes, some mistakes have been made. There is now in the Parliament of Nova Scotia a representative of the working-men who is giving special attention to what he considers their best interests; and some of the legislation complained of by Mr. Poole is attributable to the evidence of that gentleman. It is possible that in his efforts he has asked the attention of the legislature to some measures which were open to debate there; and which other members, not being so well informed on the matter, may not have gone so deeply into. I am willing to learn, and the purpose of my presence here to-day is not to presume to teach this gathering of mining men, even about the mining laws of Nova Scotia.

There was a tendency on Mr. Poole's part to undervalue the certificates. It is quite possible to underestimate; but these certificates should be received broadly. A medical man is not necessarily a man of great skill. He gets his diploma and a big red seal, and he is sent out to cut our leg; if we are fortunate or unfortunate to fall into his hands.

These certificates only prove that a man has received a certain measure of training, and if that man possesses brains and judgment, he should be qualified to do the requisite work. Perhaps the strongest point made by Mr. Poole is that all legislation in respect to mines should be brought about, not in a haphazard way, but that it should pass under the view of an officer of the Government of the province. But that is a matter more likely to commend itself to members of the province than our friends of the United States. Perhaps the distinction between the British and American Governments in this matter is that the legislation in British provinces is largely directed by the cabinet, and in many of the most important things the Government assumes the direction and the legislation ; and in the main, that has a wholesome effect. But it is quite possible there to overdo things ; and the private members in Parliament are disposed perhaps to think that the Government may want to interfere with private liberty with which all Governments should be careful not to interfere. But in the United States you have no Government in Parliament. The Government is *outside* of Parliament, and that is on the floor of Congress. Every member has the same right as his neighbor ; every private member has the liberty of introducing a bill upon any subject which is in his judgment for the benefit of the people. With the general tone and temper of Mr. Poole's criticism I have no fault to find. I know he has no object but the improvement and protection of our mining legislation.

I can assure him that when the next session of our legislature comes round, if he and his brother associates in mining will come as in the past and meet the members of the Government, they will find every reasonable proposition they make met in the same spirit which has been manifested in the paper Mr. Poole has read this afternoon.

Mr. Poole—I would add a word or two which I think may be considered due to myself. I did not intend to question the efficiency of the certificates given to men who were examined. I took objection to the granting of certificates without an examination, and the leaving of the decision to men whom I did not consider were quite so competent to judge of a man's fitness as those who were in charge of mines. One word more, I contend that the law of 1872 contained within its provisions that which would have enabled, had it been put into practice, desirable amendments to be made to the Mines Regulation Chapter from time to time, as occasion might seem to require. The propositions I have reference to are the clauses relating to special rules; which clauses, so far as I know, have never been put into practice. I contend that if the workingmen have grievances, they can bring the matter to the Government, and the discussion can follow between the two parties supposed to be interested; with the Government as arbitrator. This I think a better system than bringing the matter on the floor of the House at the busy season of the year, when it cannot be carefully considered. After that, the Act as it stands is quite sufficient to meet all such cases.

MR. CHAS. ARCHIBALD, Gowrie Coal Co., Cow Bay, N.S.—I regret that I was unable to be present when Mr. Poole began to read his paper, and that consequently I did not hear the whole of it read. But I am very thankful for hearing what I did of it, and for hearing Mr. Fielding's able speech. It was very good of the Premier to tell us that the Government of Nova Scotia would in the future, as in the past, meet the mine operator in a broad spirit; and perhaps after the discussion to-day, he will be more inclined than ever to do so in regard to these matters. What I want to speak about, is the certificates. The laws are, of course, very good; but we who have to mingle with the men who get these certificates, have an opportunity of knowing what these examinations do for them; and we are perhaps better able to judge than others who know nothing about mining; and though I am very favorably inclined to the idea of educating men up to a standpoint of underground management, I think the province has not done enough towards educating these men. The fault I find is, that in our section of the country (Cape Breton) we find men taken from their places where they have been merely miners, and in very many cases unfit to do any work other than mining: they do not know how to put timber up properly; they know nothing in connection with underground work. Yet these men from advantages in their previous life are able to go to school for perhaps two mouths, and in certain cases, they are passed by men who never worked in a mine; but they get through and are examined by men who could not pass an examination themselves. Therefore, I say, you cannot expect these men to be fitted for the positions for which they get certificates. However, I have no doubt, when these matters are put before the Government, they will help us out, and I feel sure that the paper read by Mr. Poole will be the means of improving this particular point in connection with mining legislation in the province of Nova Scotia.

THE PHOSPHATE DEPOSITS OF THE OTTAWA DISTRICT.

By Dr. R. W. Ells, Ottawa.

The phosphate deposits of the Ottawa Valley may be arranged under two heads, viz.: those which belong to the rocks of the Laurentian System, and those which occur within sedimentary fossiliferous strata of Cambrian and Cambro-Silurian age. Concerning the latter, but little has been said of late years; but in the earlier reports of the Geological Survey, attention was directed by Dr. T. Sterry Hunt to the presence of phosphatic nodules in the sandstone of the Chazy formation at West Hawkesbury, opposite Grenville on the Ottawa River, and the opinion was expressed, that if the sandstone in which these nodules are thickly distributed were burned and ground a fine manure for stiff clay soils would be produced. Similar nodules occur at several points along the St. Lawrence below Quebec, but do not appear of such economic importance as those found near the Ottawa.

The discovery of apatite in the Laurentian rocks of Canada was first made and noted in the vicinity of the Lievre by Lieut. Ingall, in 1829, but beyond the mere mention of its presence, little attention was paid to the subject for nearly a quarter of a century. Dr. T. S. Hunt also directed attention to its occurrence in the Laurentian of North Burgess, Ont., in the report of the Geological Survey for 1847, and pointed out its great economic value as a fertilizing agent. In 1849-50, the presence of phosphate of lime in the Laurentian rocks of the township of Hull, opposite Ottawa, was noted as well also as at Bay St. Paul and Murray Bay on the north side of the St. Lawrence below Quebec. From the economic standpoint, however, these lower St. Lawrence deposits have never been made the subject of much study, owing presumably to the greater importance of those found in the Ottawa Valley.

The mining of Canadian apatite may be said to have commenced in Ontario, about thirty years ago, the first direct reference to this being found in the pamphlet prepared for the London Exhibition of 1862, by the Geological Survey of Canada, where a brief notice of the apatite deposits of North Elmsley is given. Mining, however, progressed but slowly in this section; for although the Brockville chemical works were in operation from 1869, and consumed a considerable amount of the output in the manufacture of super-phosphate, the entire production of apatite from the mines of Ontario from 1863 to 1875 averaged little more than 1,000 tons per year. This mining was carried on mostly in the form of open cuttings, the deposits where exposed being worked out in shallow pits or trenches, and deep mining was carried on to a very limited extent, the two deepest shafts reaching to a depth of only one hundred and thirty-four feet, and seventy feet respectively. This was on the tenth lot of the sixth concession of North Burgess. Subsequent to 1876 the output for this district slightly increased, the quantity extracted between the year 1878 and 1889 as given in the last report of the Geological Survey, both years inclusive, being about 16,000 tons. For the province of Quebec, the first notice of phosphate mining is found in Vennor's report for the Geological Survey for 1873-74; a few tons being taken out in the vicinity of the Little Rapids on the Lièvre in 1871. The growth of the industry steadily increased and in 1877 the total export of apatite from the mines of the province was nearly 3,000 tons. The discovery and opening up of new deposits in Templeton, Buckingham and Portland raised the output rapidly, till, in 1885, the shipments reached a total of 28,535 tons for the Quebec district alone, which amount, has, owing to various causes, apparently not been surpassed since that date.

Much has been written concerning the mode of occurrence and the geological relations of the apatite deposits both of Quebec and Ontario by geologists, mining engineers and experts of Canada, the United States and Great Britain, and a great variety of opinions have been put forth by these writers on this subject. Thus, some authors contend that the mineral is of organic origin, and urge in support of this view the presence of the ores of iron, graphite, and the peculiar fossil form *Eozoon Canadense*, found in certain of the Laurentian limestones and regarded by Sir Wm. Dawson, Dr. Hunt, and Dr. Carpenter, as representing the earliest known trace of animal life. By others the view is maintained that the apatite has resulted from the action of a solution, bearing fluorine and phosphorus, in what combination it is impossible to say, upon a bed of limestone; and that this solution traversed the main mass and was distributed by means of side fissures, the result of which upon the limestone of the bed, was to convert a portion into fluor-apatite.

By others again the opinion has been stated that the mineral has been "derived principally from the pyroxenite, in which it is generally found, that the pyroxenite itself is probably derived from igneous sources, either as submarine injections while the Laurentian rocks were being formed or as subsequent intrusions, even thongh presenting much of the aspect of bedded rock."

In Norway, Messrs. Brogger and Reusch have also maintained the eruptive origin of the apatite found in that country in rocks apparently of the same geological horizon as those which contain the mineral in Canada, and the same view as regards the Canadian apatite in the district north of Kingston, Ont., is expressed by Mr. Eugene Coste in the report to the Geological Survey for the year 1887-88. Dr. Selwyn, in a note in Report Progress for 1888-89, p. 93k, also says, "there is absolutely no evidence whatever of the organic origin of apatite, or that the deposits have resulted from ordinary mechanical sedimentation processes; they are clearly connected, for the most part, with the basic eruptions of Archæan date."

The early views as to the structure of the Laurentian rocks regarded them as in great part made up of altered sedimentary strata. These were found to be penetrated by dykes of trappean and dioritic matter and by masses of syenite, while the areas of pyroxenic rocks and quartz-feldspars which occur at various points were regarded as regularly interbedded portions of a stratified series of gneiss and limestone. Certain areas of anorthositic rocks, often of large extent, which occur in connection with the Laurentian, north of Montreal, were regarded as forming the upper member of the Laurentian system, and it was supposed that there was a gradual passage downward from this rock into the gneissic portion. The recent work on these rocks, principally by Dr. Adams, now of McGill College, but for some years attached to the staff of the Geological Survey of Canada, has shown that they are intrusive and more recent than the gneiss and limestone with which they are in contact, since the anorthosite, while sometimes occurring along the banding of the gneiss, frequently cuts across the strike of both abruptly, and has also produced a manifest alteration of the strata at the line of junction of the two series; in the same way much of the pyroxenic and quartz-feldspar rocks extend in lenticular masses along the planes of stratification of both the limestone and gneiss, and this mode of occurrence has presumably led to the supposition on the part of the earlier observers in this field, that these rocks were also to be considered as integral portions of the altered sedimentary formation of the Laurentian.

But while many of the pyroxenic and quartz-feldspar rocks do assume the aspect of bedded dykes, in other places these rocks unmistakably cut directly across the stratification of the gneiss and associated strata and penetrate the containing beds at all angles after the fashion of true dioritic dykes, and thus they furnish quite conclusive evidence of their igneous and intrusive character. But further, at a number of points dykes of pyroxene are intersected by subsequent dykes of quartz-feldspar rock, while both these in turn are cut by more recent intrusions of fine grained and dark trappean rock.

The apatite has been described generally as occurring either in the form of beds, by some, or as veins by others, while yet other authors assert that certain of the deposits are in form of beds, and other portions are of the nature of veins. By far the greater part, however, of the statements made on the subject tend to show that, in the opinton of the writers, the deposits occur mostly in direct association with stratified gneiss and limestone, the pyroxenic rocks being regarded as a portion of the gneiss formation, while their connection with intrusive igneous rocks is for the most part ignored. They are stated to occur in two ways, viz., in connection with the pyroxenic gneisses or in the crystalline limestone, either in the form of veins or scattered crystals.

In the paper publised by Dr. Penrose in 1888, "On the Nature and Origin of Deposits of Phosphate of Lime," a chapter is devoted to Canadian apatites, which is the result of a somewhat prolonged study of these deposits as they occur in Ontario and Quebec. As to the distribution of the apatite, Dr. Penrose remarks that "the mineral occurs almost without exception in association with pyroxenic and horn-blende rocks. This rule especially holds true in the Quebec district, where the phosphate has never yet been found without being associated with pyroxene rocks, possibly often of vein origin." He further states that "the pyroxene rock is never found distinctly bedded, though occasionally a series of parallel lines can be traced through it, which, while possibly the remains of stratification, are probably often joint planes, and sometimes when the pyroxene has been weathered, apparent signs of bedding are brought out, which are often parallel with the bedding of the country rock." And again he says, "the gneiss in some places has no distinct line of separation from the pyroxene, but seems to have been impregnated with some of it, forming for a few feet from the line of contact, a more or less pyroxenic gneiss, which is easily decayed and eroded by weathering."

In the report of the Geological Survey for 1863-66, Dr. Hunt discusses the occurrence of apatite in the North Burgess district, and states a number of facts, from which we learn that the mineral occurs there in two ways, viz., first in association with pyroxene, regarded at that time as a form of gneiss belonging to the sedimentary series, in which case it is generally massive; and second, in the form of crystals, often of large size, disseminated through limestone. In this case the deposit frequently takes the form of veins, the associated minerals being pyroxene, mica, sphene, etc. The close relationship of the apatite with the pyroxenic rock is, however, clearly pointed out, and the statement is made that "although not met with in orthoclase gneiss, the presence of apatite seems characteristic of the interstratified pyroxenic rocks of this section, in which it is generally found in small grains and masses, alike in the granular and the micaceous schistose varieties." A number of cases are cited where the mingling of apatite with pyroxene is readily seen, as well as of the association of the apatite with the limestone, in which case also there is a clear relationship apparent between the two, the pyroxene occurring in the form of dykes or veins which cut the limestone transversely to their strike, and in which there is very frequently a mingling of apatite and pyroxene crystals.

In cases where the apatite occurs in the limestone, both in Ontario and Quebec, the crystalline form is the predominant one. Some of these crystals are of very large size, weighing several hundreds of pounds, which are sometimes sufficiently numerous to warrant the investment of capital for their extraction. This form of deposit, however, appears to be more frequent in Ontario than in Quebec, though in the latter province several such mining areas have been worked, more particularly in the country directly east of the Gatineau.

In a report on the North Burgess district by Mr. Vennor to the Geological Survey in 1873-74, a description of a great number of openings is given, from which it is easily seen that the principal deposits in that section occur in connection with the pyroxene bands, and he states that, though many openings have been made in the crystalline limestone, the mineral in these cases almost invariably assumes the form of crystals, which, when sufficiently numerous, are of economic importance, but which generally do not compare in value with those in the pyroxene rocks.

In the same report also a brief description is given, for the first time, of the phosphate deposits of the Buckingham area, in which he states that the apatite occurs there in a pyroxenic rock, with which is associated a good deal of orthoclase gneiss; and so strong is the resemblance in some portions of the district between the apatite and the containing rock that some hundreds of tons of the pyroxene were mined by one company under the impression that the rock was phosphate.

The Laurentian rocks of Ontario and Quebec, in addition to the series of limestones and gneisses which make up the bulk of the system, contain also great masses, regarded by most persons who have studied the subject in recent years as of igneous origin, which have been intruded into the mass of the stratified deposits. These intrusive rocks are supposed to represent portions of the original magma or crust of the earth. Among these are great areas of anorthosite already briefly alluded to, in which the prevailing feldspar is of the variety known as labradorite, together with great masses of syenite and granite, diorite, trap, porphyry, pyroxenic and quartz-feldspar rocks. The intrusive character of most of these is seen in their action upon the strata which they penetrate, and in the cutting off or distortion of the mass in contact, or by the generation of crystals of various kinds in the gneiss or limestone or sometimes in the mass of the dyke itself. Some of these intrusions have exercised but little apparent influence upon the occurrence of economic minerals, but in the case of others, notably the dykes of pyroxene and quartz-feldspar, such influence is very marked.

The gneissic portion of the system comprises rocks of various kinds, certain portions being largely quartzose, while others are almost devoid of quartz. Certain bands are black and hornblendic, while others are red from the prevalence of red orthoclase feldspar. Other bands again are highly garnetiferous while at times scales of graphite are so thickly disseminated as to make their extraction and purification a matter of economic importance. In certain areas, bands of limestone, generally of some shade of white or grey, are found and these are occasionally greenish from the presence of serpentine, in which case not unfrequently small veins of asbestus or rather chrysotile occur, which in several localities have been worked to a limited extent.

Over large areas the series as a whole frequently present a well banded or stratified arrangement as if resulting from the alteration of sedimentary deposits. In the areas now regarded as intrusive, while stratification does not appear, a certain foliation is manifest, not only in the syenites and anorthosites but in certain portions of the pyroxenite areas, which structure is, however, very probably due to pressure during the great period of crumpling to which these rocks have been subjected.

At different points throughout the district north of the Ottawa, more particularly in the area celebrated for the deposits of phosphate and mica, the relations of the several masses of the intrusive rock to the surrounding gneiss can be well studied and in order to depict these more clearly a series of photographs were taken for the Geological Survey of Canada during the past season by Mr. H. N. Topley, which have been colored to show the gneiss, the pyroxene and quartz-feldspar and the apatite.

Among mines thus illustrated are the Little Rapids, the London, the North Star, the Villeneuve, Crown Hill and High Rock in the Lièvre district, and the McRae mine in the Township of Templeton.

In the last named mine the pyroxene dyke which carries the apatite cuts directly across the strike of the gneiss, and has been mined out almost entirely for nearly a hundred yards along its course, the sharply defined contact of the edge of the gneissic strata with the mass of the dyke being well exposed. At the Little Rapids mine the pyroxene cuts the stratification of the gneiss at an angle of about thirty degrees, so that in the open cut which is left by the removal of the pyroxene, the edge of the gneiss is also brought into view. At the London mine, the pyroxene for a part of the distance is intruded along the lines of stratification but the contact of the two series of rock is abruptly and clearly defined At the North Star mine most of the principal openings are in the pyroxene dyke which follows the strike of the gneiss, but at several points in its course the gneiss is thrown out of its regular strike by the agency of the intrusion.

The great dyke at the Villeneuve mica mine consists largely of quartz and feldspar. It has an exposed breadth of about fifty yards and follows closely the stratification of the gneiss, but at several points spurs break into the rock along the contact. At Ross Mountain, Crown Hill and High Rock, as well as at the mines to the north in the direction of the High Falls the country gneiss which here forms a series of hills from 500 ft. to 700 ft. above the River Lièvre is intersected by a series of pyroxenic and quartz-feldspar dykes. Some of these apparently run along the lines of stratification of the gneiss, while others break directly or transversely across the gneissic strata; and at many places the different dykes interlace one another in a wonderful manner. At Crown Hill the great masses of pyroxene have thrown the gneiss entirely out of its normal strike, while several of the pits show a capping of gneiss above the intrusion. A similar feature of the gneiss and pyroxene is seen at the North Star.

That these masses of pyroxene are deep seated is seen at the High Rock and the North Star workings, at which points the openings at the summits of the hills are at least 600 feet above the river at their base, while the lower workings at the North Star have reached a vertical depth of at least that extent, and at the High Rock, the most productive ground at present is from the level lands near the base of the hill at a depth of over 400 feet from the surface workings. In both these mines, which are specially cited as showing the greatest depth of workings, the prospect for successful mining in so far as the quantity of phosphate is concerned, is no less satisfactory at the bottom than at the top. In fact, in view of the intrusive nature of the apatite-bearing rock, it would appear that the old contention put forth by some that the workable deposits were superficial in their character must now be set aside, and it may be regarded as reasonably conclusive that the extraction of this mineral in the pyroxene district will be limited only by the state of the market and the increased cost of mining from greater depths. The peculiar interlacing of the several kinds of dykes is well seen at Crown Hill and High Rock, where in one of the pits of the former mine the pyroxene first cuts the gneiss, and is in turn penetrated by a broad dyke of quartz-feldspar, while both are intersected by a four foot dyke of fine grained black traprock. Not only is their intrusive character in this way clearly shown, but this view is supported by the presence of various zeolites, and other minerals peculiar to igneous rock, and in crystals of sphene, zircon, mica &c., near the contact with the gneiss.

In the study of the apatite deposits themselves at many points, a feature in regard to their occurrence was noted which is worthy of mention. Thus while the mineral is in places disseminated more or less through the mass of the pyroxene dykes it does not appear in connection with those of quartz-feldspar, with which however mica crystals are frequently found; as in the case of the great dyke at Villeneuve. Further it will be seen from the study of the pyroxene dykes themselves that many of these contain little or no apatite whatsoever, and that in the case of the workable deposits, the mineral is almost always in close proximity to the contact with the gneiss, and this is a point of importance to be observed in the search for as well as the working out of these deposits. At High Rock and the mines in the vicinity where the pyroxene dykes are numerous, masses of gneiss, often of limited extent are held in the pyroxene, but the occurrence of the phosphate in close proximity to the gneiss is seen in nearly every one of the many openings in this district. No deposits of any economic importance have been found in the regularly stratified country gneiss at any point, though an occasional crystal, sometimes of large size has been found.

At the North Star mine, in the main pit, which has a depth of over 600 feet, two irregular deposits of apatite are seen in the upper workings. These do not show the structure of regular veins, but, while pursuing an irregularly defined course in the walls of the cut, gradually approach each other as they descend. Ramifying branches are given off from either side of the main deposit, and the quantity of the apatite increases or diminishes at various points throughout the extent of the opening; the prospects for successful mining being apparently as good at the bottom of the shaft as at the surface. From the series of openings made on this property, it would appear that the apatite follows a somewhat regular course in the pyroxene near the gneiss, but occurs principally in a series of large bunches or chimneys connected with each other by smaller strings or leaders. Sometimes these pockety bunches of ore are of irregular shape, and yield hundreds of tons, but present none of the characteristics of veins, either in the presence of hanging or foot walls, while many of the masses of apatite appear to be completely isolated in the mass of pyroxene, though possibly there may have been a connection through small fissures, with other deposits. The lack of any connection between these massive apatites and the regularly stratified gneiss is evident; and their occurrence in the pyroxene is further evidence in support of the view that these workable deposits are not of organic origin, but confined entirely to igneous rocks.

In certain cases where a supposed true vein structure has been found, such structure can be explained by noticing that the deposits of phosphate occur, for the most part at least, near the line of contact, between the pyroxene and gneiss. The latter of these, reached in the excavation, has been regarded by the miners as constituting the foot wall, owing largely to the difference in character between it and the rock which carries the apatite, and also to the fact that the occurence of the mineral ceases when the gneiss is reached. No true hanging wall, in so far as I have been able to study the deposits, has ever been found in connection with the pyroxene-gneiss deposits; but frequently, in the case of dykes of moderate extent, where the gneiss is in contact in both sides of the pyroxene, the apatite is found along both margins of the intrusion. This mode of occurrence also accounts for its continuance along certain regular vein-like lines, since the apatite generally follows closely the course of the dyke.

While as has already been stated igneous and intrusive masses and dykes occur at many places in the Laurentian the area of the pyroxenic apatite bearing rock, is in so far as at present known quite limited; for as in the case of the Eastern Township serpentine, where but a comparatively small portion of the rock is asbestus producing so also much of the pyroxenite is apparently non-productive of phosphate. This uncertainty as to the extent of any particular deposit should be taken into careful consideration when investigating the merits of a supposed phosphate area, and in some cases doubtless a diamond drill could be advantageously employed.

In regard also to other deposits of the economic minerals found in the Laurentian rock, such as graphite, mica, asbestus, and presumably to some extent at least the iron ores the same association of intrusive dykes is observed. Thus in the asbestus mines of Templeton the asbestus bearing serpentine occurs in a narrow band adjacent to a dyke of whitish crystalline dolomitic looking rock, somewhat calcareous but which on examination apparently possesses the structure and properties of a calcareous pyroxenic dyke. In the serpentine near the intrusion, the asbestus occurs mostly in small veins, the fibre varying in length from mere threads to half an inch, though occasionally several of these unite to form a vein of an inch or even sometimes longer. That the serpentineous quality of the limestone, upon which the asbestus depends is due to the action of intrusive rocks would appear from the fact that wherever serpentineous limestone occurs a dyke of diorite, syenite, or quartz-feldspar is in close proximity. So also in the case of the disseminated graphite it is found that near the large deposits or areas of graphitic gneiss, masses of pyroxene or some allied rock occur which have evidently exerted a metamorphic action upon the adjoining strata, while most of the mica deposits occur as crystals either in the mass of the dyke itself, often in this case, a quartz-feldspar or in the gneiss, or limestone near the contact.

From the evidence just presented, regarding the intrusive origin of the pyroxene or apatite-bearing rocks, the question of the formation of these mineral deposits may be briefly discussed. From many analyses, we know that all pyroxenes contain a very considerable amount of calcite, ranging from twenty to nearly thirty per cent. Since, then, the pyroxene in its intrusion with the gneiss must have ascended along lines of fracture or least resistance, it would appear reasonable to infer that vapors charged with phosphoric acid, ascended along such lines, rather than through the mass of the dyke, and that in certain portions in proximity to the margins of the dyke, these vapors impregnated the softened or heated mass, from which, as a result of chemical action upon the calcareous portion, the phosphate of lime was produced. The mineral would, therefore, appear to owe its origin to chemical agency, rather than to organic.

NOTES ON HYDRAULIC MINING IN BRITISH COLUMBIA.

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By Mr. Jas. McEvoy, Ottawa.

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In the first efforts of the pioneer gold seekers, the gold was extracted from the gravel simply by the use of the pick, shovel and gold pan or rocker. Sometimes a sluice box was added and the "pay dirt" shoveled into it was washed by a stream of water, the heavier materials such as gold and platinum sinking to the bottom were caught and held by the riffles or cross-bars, there placed for that purpose.

This method, of course, was only applicable to the shallow diggings, and as the greater part of the diggings, especially the richer part, were deep, operations had to be conducted on a large scale. Accordingly shafts were sunk and tunnels driven to "bed-rock" and the richer gravel was carried to the surface and there washed in a sluice box in the ordinary way. In some cases the material was raised by hand power, but in the larger works steam or water power (generally the latter) was used. Where tunnels could not be driven to drain the mine, such power was essential to remove the water. The degree of excellence obtained by the miners in manufacturing the machinery for the application of water power, is a matter of surprise, considering the crude nature of the material of which it had to be constructed.

After this manner all the paying creeks discovered were worked, and at the time, by many, they were thought to be worked out; experience showed, however, that although most of the gold was confined to the lower gravel a considerable amount was distributed throughout the entire deposit of the creeks. A short statement of the manner in which the placer gold was deposited will explain this.

During the period of erosion, before the glacial period when the creek beds were worn down to the form in which the bed rock lies at present, the particles of gold set free by the grinding action of the boulders, collected in the bottom and were not carried far on account of their weight. Sometimes during this period the course of a stream became diverted to a new direction in which it continued to run, thus leaving an older and a higher channel to one side. The existence of such channels is often a matter of speculation to the miner and the solving of such a question is one of the ways in which a geologist can be of practical assistance. The power which caused this erosion gradually lessens in force and the channel begins to block up and is slowly filled to the height of the terraces now found lining the sides of the valleys. During this second period particles of gold are still being carried downward and are necessarily scattered more or less throughout the deposit. A third or last period is marked by the water again cutting a channel through the deposits of the second period and in a natural way separating the gold therein contained and collecting it at the bottom of the present channel.

The quantity of gold deposited during the second period mentioned is not sufficient to pay the miner operating in any of the ways already mentioned. To separate this gold the hydraulic system is used, which at the same time collects all that was missed by the comparatively incomplete methods previously employed.

All the claims on a creek or part of creek suitable for working by this method are amalgamated and beginning at the bottom the whole creek is washed out. A stream of water brought from wherever attainable, often from a great distance is, under a head of one to two hundred feet, directed against the gravel bank which slowly melts under its force. The mouth-piece, called a "Monitor," is so constructed with a universal joint and counter-balanced as to be easily operated by one man and pointed in any direction. Such a stream is very effective against a gravel bank, large rocks and embedded tree trunks being quickly dislodged. All the water flows off through a flume carrying with it the smaller material and boulders up to 4 or 5 inches in diameter. The larger boulders are removed and piled up on one side. The flume is constructed of boards and is water-tight with the bottom paved with sawn blocks to withstand the great wear and tear of the flowing gravel.

The most difficult problem to be contended with is the disposal of the tailings where the grade of the creek below the place of operation is low, when the flume has to be carried a great distance to a suitable dumping ground. Unless there is a sufficient supply of water the material frequently blocks up in the flume, thus necessitating watchmen to keep it clear. Sometimes it is found practicable to bring an additional stream of water into the flume some distance below the place of operation which ensures a safe transfer of all tailings from that point downward.

The gold is caught in the same manner as in the ordinary sluice box by riffles. Where very fine gold exists blankets are placed in the bottom of the flume or sometimes amalgamated plates or mercury. These riffles should be placed at a sufficient distance from the commencement of the flume to allow the gravel to be well washed so that the particles of gold may be well polished before coming in contact with the amalgamated plates. There is no doubt that some fine particles still escape but it is safe to say that this method by far exceeds others in its closer approximation to a complete extraction of the gold.

Many localities in Cariboo have been extensively worked in this manner for years; notably Stout's Gulch, Conklin Gulch, Grouse Creek, the hillsides of William's Creek, North Fork of Quesnel River, etc., etc. Many still remain untouched by the hydraulic system, some have never been "bottomed" even by shaft; notably Slough Creek. All the tributaries of the upper part of this creek paid well, but the presence of "slum" or soft mud in the bottom of the creek prevents the miners reaching the bottom as the mud oozes upward filling the shaft as quickly as it is removed. A company is now beginning operations on this creek with very good prospects of success.

Charters have been issued to work several of the larger creeks by the hydraulic system or otherwise, but as the grade is generally very low and the bed rock deep, a great expenditure of capital is required before any paying results can be obtained; however there is little doubt of a rich harvest eventually rewarding the undertakers.

Several machines have been invented for working gravel deposits. Their object being to overcome the difficulty of removing the tailings, and to dispense with the necessity of a large supply of water. Once these machines are in operation, less than ten miner's inches of water suffices.

The tailings are carried up an elevator and piled to one side, drainage thus being only required to remove the water.

During the last few years the hydraulic system has been applied to the low terraces and river flats along the Fraser River. The gold here is generally confined to one layer of gravel, but the covering is too deep to allow of it being profitably removed by hand. In operating this sort of ground, care should be taken to secure the shortest transfer for the tailings to a dumping ground. This is generally accomplished by working from the river front backward at right angles, across the claim.

Before closing it would be well to pause long enough to consider the ultimate profit or otherwise of such enterprises. As far as the creeks of Cariboo are concerned there is an undoubted benefit with no after bad results but when the terraces of the Fraser River come under consideration, it is not so easy to say so. Unquestionably it is profitable to the owners and also to the country in proportion to the amount of money spent in wages and for supplies. On the other hand if the terraces so worked were suitable for agricultural purposes there is a permanent yearly loss for ever afterward, even if such land had required irrigation, for where water can be had for hydraulicing it can also be obtained for irrigating purposes. The land worked over by this process is rendered for ever useless as it is covered with bare boulders to a depth of 3 or 4 feet and over. Sometimes in addition to this land being destroyed the tailings instead of being dumped into the river are scattered over other lower terraces or flats thus doubling the damage. This question was for years a matter of litigation in California and was eventually decided against the miners, all such operations being prohibited in future.

DISCUSSION.

Dr. Raymoond—The closing sentence of Mr. McEvoy's paper seems to call upon some of us from the other side of the line to speak; and, as I was United States Commissioner of Mining for a good many years, and have some knowledge of the history of mining in the State of California with regard to the effect of the tailings upon the land, and also the effect of the subsequent action of the land owners, upon the owners of the tailings, I will ask the privilege of being allowed to say a word or two.

In the first place, whatever may have been the wisdom on other grounds of the legislation which took place in California—the litigation and legislation by which hydraulic gold mines of that State have been shut up for a good many years—nobody can deny the the unfortunate effect of that legislation in an economic way upon the interests of California. For it had come to pass that just at that time what is known as the silver question had produced, not only in the United States, but in all civilized communities, owing to the relationship of exchange, a very great deal of perplexity and trouble, and the stoppage of hydraulic mines in California just at the time when they would have become and continued until now to be a source of large annual production of gold, aggravated a trouble which was due on the other hand to a very extraordinary increase of silver. By our double action in the States, on the one side by shutting up 10,000,000 of gold per annum, and on the other side by a sort of legislation in regard to silver ores, which stimulated the production of such ores outside the States, and which has in that way established in Mexico, largely with American capital, a capacity only second to that of the United States, we have halved our production of gold; and on the other hand doubled our production of silver. Thus we have in both directions done the utmost we could to aggravate much of the trouble which has afflicted the countries of the world.

Now, as to the wisdom of that legislation in California, taking another standpoint altogether; namely, the standpoint which I have no doubt Mr. McEvoy takes, the interest of the future and permanent value of land. Perhaps I am a little prejudiced against the grangers, but I think that the question, and the answer to it, depend very largely upon another question, namely how much land are your tailings really spoiling and what is the land worth now, and how much is there left, after you have spoiled it, for the ordinary uses of mankind? In other words, how much land can you give up to the industry of mining gold? We give up land to other industries. We do not insist that persons who have absorbed land by putting brick buildings on it have thereby necessarily injured humanity. Therefore, it is a comparative question; though I grant freely it is a serious matter to hurt agriculture. But the natural law makes agriculture, even if the so-called agriculturist has come and settled in the neighborhood after the nuisance; as was the case in California We went to California and found gold; and we developed the country which never would have been thought of but for the gold. We began to dig gold, and the grangers who came to settle in the villages and afterwards sued us for damages, came there on purpose to be injured. They were like the virgins in Don Juan, who, Byron tells us, stood around waiting for the ravishing to begin. They—the grangers—could not make anything in farming, but they came there; and that to some extent was the nature of the persecution in California; which ended in shutting up all hydraulic mines. The pretence about the "navigable" rivers I think none of us need discuss. Those of us who have seen the St. Joachim and Sacramento Rivers will agree I think that the sooner they are made unnavigable the better.

It is a very curious fact that all over the world that agriculture fills up the rivers more than mining. As a matter of fact, in some cases in California, we went down to the beds of the rivers and found the nuisance there. It came from the plow of the granger, who, having broken up the surface of the ground, had made it easy for the rains to wash it into the rivers. But that mere injury to navigation was not, after all, everything. It would be dishonest to deny that the serious matter was the covering of arable ground with sandy deposits of tailings which certainly was not arable; and of course, if we had covered it several feet with boulders we would have made the matter still worse. But I take the freedom of saying that I do not think the amount of land injured in hydraulic work by being bared in that way would be a very serious matter. A much more serious matter is the actual disposition of the tailings; and that is an evil on the face of it that goes on for years and years. You may be careful with your tailings. You may build up in the last 30 years strong timber dams, and you pile them up and keep them out of the way, But by and by when you are gone, and the property passes into the hands of another company, and they do not want to repair merely ancient dams; and presently some extraordinary freshet comes along, and then the tailings of a generation go down and spoil a county; and it is a very serious matter, and no light matter to settle where the line should be drawn. These things, I think, settle themselves better than we can settle them by legislation or principles. The case in California is settling itself to-day. Both parties are acting in great harmony, in trying to make the sand pay the expense by putting in dams which will impound the tailings safely that will probably pass by.

There is another fact, namely, that farming people do not find it any use for them to have arable land, and have nobody to eat the products. They have been ruined quite as much as any of us. I have been in county after county in which the closing of the mines has ruined the farmers. This is particularly so in California, as the farmers do not raise great things as in the East, like wheat, but go in for the cultivation of vegetables and garden truck, &c., for sale in the settlements. No customers anywhere in the world are as good as miners. They will pay almost any price. And so their market is the best market in the West. But there are a great many instances in which the land to be destroyed is not worth enough to worry about. There is a great deal of land yet left on mother earth; and we can spare some for towns and some for universities and some for—hydraulic mining.

Mr. McEvoy—I might say that in British Columbia the situation is peculiar as the amount of agricultural land is small compared with that of California.

In Cariboo we set an example which I think the Americans might follow; as the Government agent there undertakes to extend the bulkheads from time to time to keep the tailings back, as necessity requires.

Capt. Adams—Does Mr. McEvoy know the smallest average yield of gold to the yard from the gravel that can be profitably worked by hydraulic processes?

Mr. McEvoy—Some few cents per yard. I do not remember the exact figures.

Dr. Raymond—Our average actual hydraulic yield in California runs from 15 to 18 cents in the cubic yard. We think we could handle it at 3 cents. That would not include the cost for the tailings, and bringing water to the proper head. Our hydraulic fields in California are generally surrounded by rock. A great deal of the money has been spent there in rock tunnelling. That costs money, and takes a great deal of time; and many miles of these rock tunnels had not got fairly to work to show what they could do, when the courts shut up the business.

Mr. McEvoy—I do not know of any instance of that sort of mining in British Columbia. I quite admit the force of the argument of the necessity of sacrificing to some extent the future for the development of the present. But I would like to ask if the agricultural products of California do not to-day far exceed the mining products?

Dr. Raymond—I will say very frankly that the agricultural products of California so far exceed the mining products that they could easily afford to submit to a loss of a certain percentage of the agricultural products for the sake of the mining products. The point is really not that the agricultural products of California are not going to be destroyed or wiped out by the resumption of the hydraulic mining industry, but how much can be given up to mining.

Mr. McEvoy—All lands are the national heritage of mankind and no owner of land has a right to destroy it for any purpose and render it useless to his successors. Agricultural land will go on producing food, which is of a positive value to mankind, while gold is, of itself, no value.

APATITE MINING IN QUEBEC.

Mr. J. Burley Smith, M.E., Glen Almond, Que.

The greater portion of Apatite mined in Canada has been raised in the Ottawa district of Quebec, and as the geological phenomena of occurrence will no doubt be exhaustively treated by Dr. Ells in his paper at this meeting on the Apatite deposits of the Ottawa district, I propose in that portion of the subject I have taken up to confine myself as much as possible to the commercial and industrial aspect of Apatite mining, describing as briefly as possible the economic value and use of this important mineral and the prospects of the industry generally, especially as affecting the locality in question. The practical questions of searching for, mining and winning the mineral and its preparation for market, encroaching on the geological features only where it becomes really necessary to illustrate any point connected with the winning of the ore from the rocks in which it occurs.

To those who may be quite unacquainted with the subject I may state that Apatite is the name of one of the various forms in which phosphate of lime occurs.

It is found in many parts of the world, but nowhere equal in richness and purity to that variety discovered more than 30 years ago and worked up to the present day in Canada.

The chemical composition of Apatite is theoretically phosphate of lime 91 to 92, chloride of calcium 0·0 to 0·42, and fluoride of calcium 4·6 to 7·7. It has a specific gravity of 3.16 to 3·25 or about three and a quarter times as heavy as water and its hardness is = 5 to 6.

In appearnce it is an exceedingly beautiful mineral, semi-transparent and the Canadian varieties are generally of a bright sea green, red, brown, grey and bluish, according to the admixture of various substances which enter into its composition.

Its chief economic value is for the phosphoric acid obtained from it and its chief use is in the manufacture of superphosphate fertilizers or plant food used in agriculture to restore to exhausted soils those elements of fertility taken from it by continual croppings.

In the year 1669 Brandt, of Hamburg, discovered phosphorus to be one of the simple elements and in 1769 Scheele discovered its presence in the bones of men and animals.

It is present in considerable proportion in plants, and the agricultural chemist of to-day is able to state the exact amount found in the various roots and plants which go to make up the food supply of the world.

Phosphorus in the shape of phosphoric acid is therefore an important factor in the economy of plant and animal life.

It is absorbed as food by the roots of plants, of which it forms one of the principal inorganic constituents. The plants become the food of the animal kingdom, where it chiefly enters into the formation of bone and tissue, and is again in the natural order of things restored to the soil as an original element of its fertility, insuring a constant reproduction.

But in the artificial state of things now existing, with a dense population closely packed on small areas and far distant from the source of its food supply, these elements are not restored to the soil but are from sanitary reasons chiefly allowed to run to waste with no better result than the pollution of our rivers and streams.

Monsieur Grandeau estimated some time ago that one year's crop in France represents 298,200 tons of phosphoric acid, of which only 151,200 tons of phosphoric acid were recoverable in the stable dung, thus leaving a deficit of 147,000 tons of phosphoric acid, equal to over one million tons of superphosphate, to be made good by other means.

He also estimated that the entire number of farm animals in France in 1882, representing a live weight of 6,240,430 tons, had accumulated from their food 193,453 tons of mineral matter containing 76,820 tons of phosphoric acid.

When it is considered that this condition of things is going on in all the densely populated countries of the world, and how much phosphorous must be extracted from the soil every year to make the bones and tissues of animal life, it will be seen how necessary it is that at least as much phosphorous should be returned to the soil as is taken out of it, otherwise it will become utterly worn out and unproductive.

In the early efforts to make up the deficit, bones were used on account of the large amount of phosphoric acid contained, and were indeed the first source of supply for the manufacture of artificial manures.

From the respect we all have for the memories of our deceased friends and our desire that their bones should rest in peace, we can feelingly realize that this source of supply is inadequte to meet the deficit.

Professor Liebig once wrote the following warning:

"England is robbing all other countries of the conditions of their fertility; already in her eagerness for bones, she has turned np the battlefields of Leipsic, of Waterloo and the Crimea; already from the catacombs of Sicily she has carried away the skeletons of many successive generations. Annually she removes from the shores of other countries to her own the manurial equivalent of three millions and a-half of men; whom she takes from us the means of supporting, and squanders down her sewers to the sea. Like a vampire she hangs upon the neck of Europe, nay of the world, and sucks the heart blood from nations without a thought of justice towards them, without a shadow of lasting advantage for herself."

Notwithstanding this touching lament, it was Prof. Liebig himself who first suggested the treatment of bones with sulphuric acid, and thus started the scientific manufacture of artificial manures in Europe.

It is stated that as early as 1822 England imported over 30,000 tons of bones from Germany, and it is known that in recent years she has imported from various sources as much as from 70,000 to 100,000 tons a year.

There are of course many other sources of supply of phosphoric acid for agricultural uses, the most important of which has been guano. Since its discovery fifty years ago, as much as 400,000 tons has been shipped annually.

But it can easily be recognized that these sources of supply will rapidly become exhausted.

Basic slag is also largely used as a phosphatic manure in Germany, 30,000 tons having been used in one year.

None of these sources, however, are likely to supply the ever increasing demand for phosphatic manures, and it is to the practically inexhaustible deposits of mineral phosphates that agriculturists are to look for their permanent supply.

Fortunately for agriculture, though perhaps not so fortunately for the Canadian phosphate industry, mineral phosphates are found almost everywhere and frequently in enormous quantities.

The constantly increasing demand for super-phosphates has not had the prosperous influence on the Canadian apatite industry which might at first sight have been expected.

If Canada was the only place where the mineral existed, undoubtedly both owner of mineral lands and the capitalist adventurers would have had very fine times indeed. It is, however, found in its different varieties in many parts of the world, and the increasing demand naturally led to more energetic search and exploitation, with the result of excess of supply over demand and the phosphate market has been flooded. The reckless speculation in some countries and the keen competition to raise large quantities of ore regardless of cost, not merely to supply the demand, but to boom the mineral lands for sale has unsettled the market altogether. Prices have gone down enormously, partly because of excess of production, but chiefly, I think, because the manufacturers do not know to what extent this excess may reach, and whether it may not for many years exceed the regular demand in spite of the enormously increased use of superphosphate which is certain to follow in new countries and old, as the new land of the farmer becomes as impoverished as the latter, and the agriculturists of both become more scientific from sheer necessity.

It cannot be denied that there is at the present time a most serious crisis in the Apatite industry of Canada. In spite of the enormous increase in the supply of mineral phosphates from all parts of the known world, the Canadian Apatite has continued to hold its own up till now, partly because of the extreme purity and richness of the ore, and partly because the output is comparatively small. The shipments of Canadian phosphates have not exceeded an average of 20,000 tons annually, during the last ten years, whilst other countries have figured up to hundreds of thousands tons, and there has been little difficulty in placing her small output at remunerative prices while they were high, but now she stands face to face with keen competition and very low prices.

From the high character of the mineral is considered a valuable material in the manufacture of superphosphate, it yields a higher percentage of phosphoric acid soluble in water than any other raw phosphate material. It is much easier to grind than any other variety of mineral phosphate.

The mineral is practically inexhaustible in quantity, and the recent evidence of Dr. Ells, Mr. Eugene Coste, Mr. Ingall and other scientific geologists goes far to show that the present shallow surface pits and even the deepest one of 600 ft. (at North Star mines) are but mere burrowings compared to the almost limitless depths in which these rich deposits may be lurking, and who can define their magnitude and purity under these conditions. But it is difficult and costly under any circumstances to mine, and it is only by patient scientific and systematic working, that these mines can be profitably carried on in the future.

It depends, therefore, in a great measure upon the present attitude of the owners of mining land and the capitalists who have already invested large sums of money in the exploitation, whether the industry is to die out or become one of vast importance.

Prices are very low now and I do not see any prospect of a permanent rise for some years to come and we may be quite sure that the old high prices are not ever likely to occur again.

The characteristics of the deposits of phosphate of lime of other countries and the methods applicable to working them go at the same time to show that prices are not likely to be any lower than at present and what we miners have to do now is to try and "cut our coat according to our cloth," and see if by better and more economical methods of working we cannot mine and ship phosphate to meet the present prices.

High prices for both high and low grade ores have resulted in careless hand to mouth ways of mining.

The mineral from its bright and attractive appearance and its beautiful crystal and color so distinctly in contrast to the rocks in which it occurs was easily discoverable. It was indeed found by accident and was known to lumbermen and backwoodsmen by sight long before its value as a commercial commodity became known. A demand sprang up for it and the farmers and settlers commenced to dig and quarry it from the surface "shows," as they are locally called.

The vast volume of rock known by the name of the Laurentian formation in which the Apatite occurs runs from north-west to south-east through the Provinces of Ontario and Quebec, and is characterized by the bold outline of its synclinal troughs and anticlinal ridges and it is when the ridges of gneiss, with its overlying limestone come to the surface that the Apatite deposits have been principally dicovered and worked.

The Apatite "shows" are sometimes found as superficial deposits in hollows of the rock, oftentimes covering large areas showing something of the appearance of beds but being mixed with the partially decomposed portions of the rocks in which the phosphate is found and being more especially degraded by the decomposition of the pyrites, which is one of the most objectionable features. These bonanzas are not always so valuable as would at first sight appear from their accessibility.

They have on the contrary but too often led to the squandering of vast sums of money in the indiscriminate digging of useless holes all over the property in search for similar deposits, rarely with success, without serving as a guide in any way as to the true method of occurrence.

Local prospectors have been employed by speculators to uncover and lay bare to the sight these attractive shows, maps have been made by irresponsible experts and illuminated with dubs and splashes of emerald green or red covering acres of ground, regardless of scale.

The very name of Apatite has been used to account for the apparent want of order and system.

Even practical miners and experienced mining engineers have been misled by the indisputable fact of having placed before their eyes large uncovered surfaces of the mineral, often mere crusts of a few inches thick. No one can walk over the estates of some of the mines now properly developed without observing what large sums of money have been spent in sinking holes which have yielded nothing and proved nothing.

The earnest attention of scientific geologists has however recently been attracted to the subject and the result of their patient investigation proves that the occurrence of Apatite is systematic and orderly like all things in nature and will be of immense advantage to miners in the future by showing how the mineral lies and how it should be sought for. Occasionally these surface "shows" have led down immediately to large pockets or bunches of very high grade ore from which many thousands of tons have been raised but this is exceptional and the miner who follows this plan is only too likely to sink a great number of dead holes.

They are, however, clearly the indication of leads or deposits in the neighborhood, and if rightly followed up in logical sequence in prospecting, the intelligent miner will be able to accurately locate the position and direction of the pyroxene dykes in which the real and permanent deposits occur.

Sometimes the "shows" appear on the surface like the outcrops of true but irregular fissure veins, having clearly defined hanging and footwalls, and have been followed down to a considerable depth, showing also a more or less regular continuity of direction.

Again they are found in bunches like pipe or pot veins.

But in whatever variety, except the surface bed shows, in which case the apatite is mixed with fragments of gneiss, pyroxene, pink calcite, feldspar, etc., very frequently containing a number of apatite and pyroxene crystals and earthy impurities forming a debris, which is evidently the result of decomposition or weathering of the exposed portions of the upturned edges of the rocks which has most likely been washed or rolled away in the course of time from their original locality, they are always found at or near the point of contact of the pyroxene with the gneiss.

Whatever may have been the origin of the apatite and how it came there, there is no question that the ore is found only in and accompanying the pyroxene which, according to the opinion of the best authorities, are immense dykes intruding through the stratified gneiss to the surface, not always, however, coming quite to the surface, but sometimes covered with a cap rock.

Experience shows that it is useless to look for apatite away from these conditions.

The deposits having the appearance and many marked characteristics of pockety veins, cannot be called true fissure veins, but having these characteristics they can and should be sought and mined for on a system applicable to vein mining. They have often walls corresponding to the foot and hanging walls of true fissure veins. Their direction is not uniform, but generally N.E., S.W., varying some degrees, but a group of these deposits appear to always run parallel to the same axis, having also the same inclination, and though the so-called veins may alternate from wide bunches to tiny thin strings, they never quite give out, and may sometimes be traced for a very long distance.

Again they are traversed by dykes of evidently much more recent intrusion than the pyroxene dykes cutting right up through them to the surface where they present the appearance of hogs' backs. At these points the vein-like deposits are thrown to one side or the other, forming, as it were, cross courses, often widening out at the junction into considerable pockets. Perhaps the strangest feature is that the so-called vein will often continue to follow the face of the cross dyke for a considerable distance latterly and frequently right up to the surface. I am quite unable to account for this unless it has been by the refusion caused by the igneous effect of the last intrusion. The great number of apatite and pyroxene crystals near the surface strongly favoring this view, together with the burnt appearance of the rocks at the surface.

In following the lead it is not "struck out" or lost, but continues on the other side of the dyke under the same conditions, though thrown to right or left, as the case may be.

At or near the junction at the surface, irregular pockets of considerable size are often found in the burnt rock, containing ore of very high grade though often discolored and degraded by admixture with the decomposed pyrites, etc.

In some cases, as in the celebrated Emerald mine on the River du Lievre, and the Squaw Hill mine adjoining, four or five of these so-called veins occur, having all the characteristics I have described. The dyke cuts across on the Emerald property and the leads are thrown, but continue again on the other side of the dyke, retaining, with singular regularity the distance between them in parallel. On the Emerald side side the pocket called the "Big Murray Pit" occurs, from which thousands of tons of ore have been raised, and on the other side the almost equally celebrated Grant pit occurs, which appears to be on the same lead, allowing for alteration caused by the throw. Owing to the rugged character of the ground on the surface and the dumps surrounding the workings, it might not at first sight be noticeable, but from an actual survey made, both of the surface and the underground workings, these leads are found to be almost parallel, running in the same line of direction on both properties, viz: N.E., S.W. On the Emerald side of the dyke the veins are five in number, and on the Squaw Hill side four, showing that there is still one undiscovered on the latter, although since the survey was made, certain indications of the fifth have been found, which point to its exact and regular occurrence.

Now from the general appearance of the surface and underground workings of all the mines I have visited in the Ottawa district, the same characteristics are traceable in all, and there is clear evidence to show that if all the mines of Quebec and Ontario, those fully developed, and those yet only in the prospecting stage, were properly surveyed and carefully plotted, the result would prove that the uncertainty of the occurrence of apatite has not been established by the collateral evidence of scientific geologists, but is rather the result of the fragmental and crude experience of isolated prospectors and miners operating over a very large area, forming strange and mythic reasons to account for something they could not be expected to understand or explain.

Geologists cannot afford to be dogmatic, but the exhaustive reports and essays of these geologists of Canada who have spent so much time in patiently investigating the subject, appear to agree generally in their deductions, at any rate within recent years, and seem to prove conclusively that there is no very great uncertainty in the mode of occurrence of this mineral if properly approached, and that starting from the gathered facts and experience already laid open to him, the explorer may find it easily and with certainty, and mine it with the economy which can only result from knowing definitely how and where to begin, and how to work it when found.

The improved geological maps which are sure to be the outcome of these researches will be of the greatest use to Apatite miners in the future as they will show more or less definitely the position and composition of the zone in which they have to work.

The colored photographs of Dr. Ells, showing the position of the pyroxene dykes and the occurrence of the Apatite in them are of the utmost importance to the miner who may at a glance ascertain more than pages of written explanation could give him. On commencing to work a new property the miner should make himself thoroughly acquainted with the rocks in which he has to mine, firstly by reading the results of the investigations of those who have made a study of the matter for years, and by a careful examination of the specimens in the magnificent collection in the museum of the Geological Survey at Ottawa. He should then visit the other mines in operation in his neighborhood and see what has already been done—not necessarily for imitation.

Having made himself thoroughly acquainted with these he should carefully prospect and survey his own ground, making only such preliminary shallow trial pits and costeenings as are necessary to establish the position of his mineral ground which will be found usually to occupy a small area compared to the vast volume of barren rock composing the general area of his property.

The position and run of this can best be ascertained by baring the rocks at or near the occurrence of the pyroxene, in the neighborhood usually of the easily seen surface shows—carefully avoiding undue disturbance of the natural appearance of the surface of the rock by blasting if possible.

The small trial pits and trenches should as he proceeds of course be marked down on his plan. From the comparative position of all those which show phosphate, or indications, he will find that there is a logical sequence of direction, and his previously acquired knowledge of the rocks themselves will enable him to locate the zone in which he has to operate.

He should above all things avoid the unnecessary sinking of big and deep shafts wherever phosphate "shows" may be found as has been the old custom, in the effort to raise a large quantity of phosphate immediately. It is only in very rare instances indeed that these costly shafts sunk down to follow "shows" have ever proved successful.

Mining companies have themselves been responsible for much of this wasteful kind of work by expecting their agents to begin and raise an immediate output the first year equal to that of the annual output of the best known and successful mines.

They themselves having been probably misled by the reports of these experts who have too frequently glowingly described them after only a hasty and superficial examination.

Mining for apatite requires as much skill as any other mineral of equally difficult occurrence and it is better for the manager or agent to spend twelve months or more in correctly locating his mineral ground and developing it with a view to the future regular output rather than in immediate returns.

Having located his mineral ground, his technical knowledge, no matter in what kind of mining it has been gained, will then enable him to estimate the amount of development work to be done and the machinery and tools most adapted to be purchased for his work; and still better, he will be able to consider and estimate more accurately whether or not the prospects of his mineral ground are sufficiently promising to warrant the expenditure of his company's capital in permanent development work at all. In some cases it will be found that it is better to abandon his ground altogether at once and seek a new one.

Whereas had he adopted the old custom the capital of his company would at this stage have been considerably expended in costly shafts, etc., without proving anything more.

The writer's own experience is that the sinking of one deep shaft in properly located mineral ground is a better test of the whole property than half a dozen shallow ones put down at once and almost at random and before the agent could possibly have really understood his ground.

As has been shown by experience that the largest deposits of Apatite occur at or near the cross dykes and may be reasonably inferred to continue so in depth, it may be assumed that no better spot could be selected at which to sink the shaft, keeping far enough away from the dyke to avoid striking its wedge-like angle at some depth down, and having to sink for the rest of the distance in the extremely hard rock of which these dykes are composed.

It is well to commence the shaft vertically if it is intended to be a permanent one and carried to a great depth, because it is more economical in the regular working afterwards, for well known reasons—making cross-cuts at intervals to test the country rock.

A diamond prospecting drill bringing out cores is very useful for testing the ground as the shafts descend.

But if the lead has a considerable inclination, it is desirable and more economical to sink the shaft in the lead and at the same ascertained angle, because it would then be sunk in the pyroxene which is a comparatively soft rock and it would take in all the phosphate bunches which might occur and a more or less quantity of the ore might be raised, though unless these are very large it is not very profitable, as the ore is very much mixed with the debris of the shaft sinking.

In either case suitable provisions should be made in sinking the shaft for making galleries or drifts at intervals for testing the extent of the lead right and left, and for crossing into other parallel leads—and for permanent drifting and stoping should the ground prove rich. I may here state that phosphate lends itself very well to the operation of overhead stoping, and by an arrangement of head stalls the mineral may often be obtained very pure and unmixed.

If it is determined to sink a permanent shaft it is always advisable to erect proper buildings and machinery at the pit top at the very beginning, because the economy and speed in sinking a shaft depends very much on the proper arrangement of air compressors, rock drilling, hoisting and pumping machinery.

In commencing a permanent shaft, consideration should be given to the question of fuel and water required for boilers and machinery used. If there is any water power in the neighborhood advantage should be taken of it, even if at a considerable distance away—the cost of long transmission pipes and loss in transmission not being of such importance as the permanent purchasing of fuel and its haulage up to the boilers for steam power.

Cobbing and Separating the Ore—The old plan of breaking off the ore from the the pyroxene and other impurities with hammers and the usual picking and screening is perhaps the most unsatisfactory and costly part of the whole question of winning the ore. It is an utterly crude and ill adapted method, and until a mechanical method is worked out by which the ore can be separated and classified there is little prospect of phosphates being prepared cheaply enough to meet the requirements of low market prices, or even the rise which we hope for and anticipate.

The hitherto imperfect separation cannot better be shown than by the fact that while theoretically apatite contains 91 to 92 per cent. of phosphate of lime, the highest grade of that now prepared for market does not exceed 80 to 86 per cent. at the outside, while the second or lower grade does not exceed 65 to 70 per cent.

On account of the vein stuff and the composition of the impurities found mixed with the ore itself being almost alike in specific gravity it is a most difficult matter to achieve a satisfactory separation by mechanical means.

The writer has himself given special attention to this subject and has made innumerable experiments but with indifferent success.

It is, however, a point well worth the consideration of manufacturers of classifying and separating machinery, who do not appear to have devoted much of their skill hitherto to the separation of mineralized phosphate.

In conclusion, I would say that it is impossible to do more than give a general sketch of the apatite industry in such a paper as this, but I trust that what I have said may elicit the views and opinions of some at least of the eminent geologists and mining engineers present here to-night on a subject which all will acknowledge to be of very great importance to the Province of Quebec.

DISCUSSION.

CAPT. ADAMS—This paper, in conjunction with Dr. Ells' paper read this afternoon, gives us a very full insight into this subject. Does any gentleman desire to make any remarks upon it?

MR. A. LEOFRED (Quebec)—What is the price at which the phosphate can be produced per ton?

MR. J. BURLEY SMITH—I cannot say exactly; but from actual account of the whole thing, and having reached a fairly workable deposit I have found it cost about about \$7.20, say, roughly, \$7 a ton, having gone through the preliminary expenses of making cross-cuts, shafts, &c. This would be for two grades of ore, 85 to 86 per cent, and between 70 and 80. However, it may cost \$10, \$15 or \$20, or even \$30 a ton; and, as Capt. Adams said, it might cost from 50 cents to \$1,000 a ton. But I think that if it can be put on the railway at \$7 a ton it will pay.

MR. W. HAMILTON MERRITT—I would like to ask, in view of the statement contained in Mr. Smith's valuable paper with regard to apatite always being present in the pyroxene belts, in which it was said it had been brought up—how is its occurrence in great numbers of crystals explained, and also its occurrence in gneiss? Because in my experience, which is not of course as great as that of many gentlemen here in actual working properties, but in examining them, I have found that if there is anything in creation that appears to be regular, it is the occurrence of apatite. And further in regard to the occurrence in pyroxene belts, while acknowledging that it is nearly always found associated with pyroxene ore deposits, how can it be explained where apatite is found entirely embedded in the calcite and also where you find it in pure gneiss existing in a gneissic formation with the gneiss? I would like to ask these questions, because it would be of interest to me to know if that has been investigated in connection with the pyroxene occurrences.

Mr. J. Burley Smith—I may say from my experience that I have never found it imbedded in bunches or any other form whatever in the gneiss.

Mr. W. Hamilton Merritt—I have seen in the Kingston district near Otty Lake what I class as gneiss, strings of phosphate occurring in a gneissic form with it.

Dr. Ells—I may say I have yet to find any case where gneiss itself contains apatite, even in the Kingston or Quebec district. In the Kingston district, it occurs in limestone in the shape of detached crystals; but in no case except in connection with pyroxene dyke.

Capt. Penhale—I have listened to Mr. Smith's paper with interest. But I think the question the gentleman on my left, Mr. Leofred, asked Mr. Smith was a very pertinent one: namely, what the price per ton would be. Mr. Smith got over this question capitally; but it occurs to me that the price of mining this phosphate is regulated by the same consideration that enters into the cost of mining other ores—that is, the nature of the bed of ore we have in the mine.

Capt. Adams—I have had fourteen years experience in phosphate; and I have learned that the cost may be stated, as I have said already, to be from fifty cents to $1,000 a ton. I am glad to see we have with us Dr. Robert Bell, of the Geological Survey, of Ottawa. Perhaps he has something to say on the matter?

Dr. Bell—I have nothing to say except that I should like to hear Mr. Merritt's question answered, to give us a rule by which we can find profitable deposits of Apatite. I would say that although I have never seen Apatite in large quantities in gneiss, there is scarcely ever a microscopic slide of gneiss made which does not show it in the minutest quantities.

Mr. F. C. Smock (New Jersey)—I might say that Apatite was mined many years ago to a small extent in Hurdtown, N.J., occurring in gneiss. It also occurs in a sedimentary form associated with magnetite near Dover, N.J., and in the well known occurrence of Apatite and Magnetite of Port Henry, N.Y. These occurrences of Apatite in true gneiss in the United States go to show, it seems to me, that perhaps we should not form too positive a rule in regard to the occurrence of Apatite in gneiss rocks.

DR. ELLS—Might I ask what sort of gneiss this is?

MR. SMOCK—It is orthoclase gneiss.

MR. W. HAMILTON MERRITT—If my memory serves me right, it was orthoclase gneiss, but not in workable quantities. And I ask how this was explained in the crystals in the calcite; and not in workable quantities, as might have been inferred.

CAPT. ADAMS—We are told by the scholars that the word Apatite comes from a Greek word, meaning to deceive, and I think it is well deserved.

THE ELECTROLYTIC EXTRACTION OF METALS FROM THEIR ORES.

BY MR. W. T. GIBBS, F.C.S., Ottawa.

We do not intend in this paper to refer particularly to any special Electrolytic process, but merely to indicate in a general manner the advances that have recently been made in Electro-Metallurgy.

More experiments have probably been made in the last few years on the electrolytic extraction of Aluminium than on that of any other metal. In spite of the fact that articles are constantly appearing giving particulars of new processes for the extraction of Aluminium, we have yet to learn that any of them are successful even as experiments, to say nothing of their commercial aspects.

We have made a very large number of tests both with alkaline and acid solutions of Aluminium salts; but in no case did we succeed in obtaining a deposit of the metal, and we think we are perfectly safe in stating that so far no method has been devised for depositing Aluminium from aqueous solutions of its salts.

The extraction of Aluminium by the use of the Cowles and similar electrical furnaces cannot properly be called an electrolytic process, for the reduction of the metal is probably due to the intense heat generated, and not to any specific electrical action.

The electrolytic extraction of copper is fast developing into a great industry and the next few years will undoubtedly see a contest between the furnace and electrolytic systems, in which the latter will surely be victorious whenever natural forces can be used as a source of power.

The process which seems to be based upon the best principles is one recently introduced by Hoepfner. In it a solution of cuprous chloride is submitted to electrolysis until one half the dissolved copper is deposited. The remaining half is then present as cupric chloride and the solution containing this is run on to the finely pulverized copper ore, which has been placed in a series of led-lined vats. By a simple reaction more copper is taken into solution, cuprous chloride being reproduced ; which by electrolysis is again deprived of half its copper. By repeating this cycle of operations it is evident that the whole of the copper is removed from the ore, and is ultimately deposited on the cathode in a state of high purity.

One of the most important points in Hoepfner's processes is the use of ferro-silicon as an anode, which is claimed not to be acted upon by nacent chlorine. Such an anode will do more to advance the electro-metallurgy of copper than any other improvement ; for hitherto the trouble has been that the anodes used were always attacked by the chlorine evolved during electrolysis.

Several other processes have been suggested and tried ; based mainly on the electrolysis of solutions of cupric salts ; but it naturally appears that the ultimately successful plant will be one in which a cuprous salt is used ; since the same quantity of electricity will deposit twice the amount of metal from such a solution as from one in which the copper is in the higher state of oxidation.

There is a large field for electrolytic separation in the treatment of the nickel-copper ores of the Sudbury district, but so far attention seems to have been devoted chiefly to furnace methods of refining. There is no doubt, however, that it is possible to refine the nickel-copper matte by electrolysis.

The first step in such a process would be to find an electrolyte which would be practically without action on nickel, and yet attack copper and dissolve it completely. The matte could be cast into plates and used as anodes in such an electrolyte. After the copper had been removed the anode could be re-cast and the nickel removed by treatment in one of the many nickel plating solutions.

It would seem to be very doubtful if it would be possible to treat the raw ore, without first roasting and reducing to a matte. The percentage of copper and nickel in the ore is so low compared to the amount of iron present that the solutions used would quickly become charged with iron, and it would therefore be impossible to deposit either pure copper or nickel, but in treating a matte this difficulty is reduced to a minimum.

Experiments have shown us that it is quite possible to remove the whole of the copper from a copper-nickel matte by careful attention to the composition of the electrolyte and the current pressure, and this without any appreciable action on the nickel present. The separation of the nickel from the remaining impurities is a more difficult matter, for the reason that the solution used attacks iron freely, and the bath in a short time has to be renewed or freed from iron by precipitation.

We obtained some very complete separations by using a strongly acid solution as an electrolyte, and keeping it saturated with sulphuretted hydrogen.

In this way the copper was prevented from going into solution, whilst the nickel was completely separated, but here again we were troubled by the iron going into solution.

The only feasible method will doubtless have to be based on the preliminary removal of the copper and the after deposition of the nickel from the residue.

Another matter of great interest at the present time is the electrolytic treatment of silver-lead ores; although up to the present time very little seems to have been done in this direction.

In the Kootenay district water powers are abundant; electricity can be produced at a merely nominal cost, and the expense of maintaining and running an electrolytic plant is far less than that of a furnace of the same capacity as is shown by the enormous development in electrolytic copper refining.

In depositing lead the greatest difficulty met with is its tendency to form trees or excrescences on the cathode; and it appears to be impossible to entirely prevent this, although by careful manipulation it may be kept within bounds to a certain extent.

Another difficulty is the tendency to the formation of a film of peroxide of lead on the anode, and thus preventing the solvent action of the electrolyte; but this is much more easily obviated than is the first mentioned trouble.

Not a few attempts have been made to refine base buillion by electrolysis, but so far as we are aware none are in successful operation.

For such a process to be of any practical value it appears to us that it should be capable of taking the raw ores and treating it directly in the electrolytic cells, without intermediate reduction in a furnace.

With copper-nickel ores we do not think such a course possible, for reasons already given; but in dealing with a practically pure sulphide of lead, or of lead and silver, the question of impurities does not arise.

Some experiments which we have made on the electrolytic treatment of raw galena have been fairly successful.

The ore is finely pulverized and laid on a carbon plate which forms the positive pole, and at the same time, the bottom of the electrolytic cell.

The electrolyte used was a saturated solution of nitrate of lead in sodium acetate, used at a temperature of 40° to 50° centigrade.

The cathode used was a plate of iron, suspended horizontally over the anode, the lead being deposited on the lower side of it. At first it seemed as though it would be impossible to obtain a satisfactory result, for the lead came down in spongy flakes, and the anode was continually getting coked with peroxide, but by a careful adjustment of the temperature and current intensity we at last succeeded in obtaining a fairly dense deposit of lead.

The whole of the lead is dissolved out of the galena and deposited on the cathode in a high state of purity, some samples giving as high as 99·97% of metallic lead. The silver remains at the anode, together with the whole of the sulphur, as a residual mud, from which it can be removed by treatment with a cyanide solution. The sulphur can be afterwards melted and cast into rolls; in which state it is worth from $28 to $32 per ton.

A plant to produce two and a half tons of refined lead per 24 hours would cost about $7,500; and the running expenses for that time would be about $15, where water power was used.

The production of chlorine gas by electrolysis, for use in the chlorination of gold ores, is now being carried out very successfully in Australia; and could probably be utilized in treating the Ontario and North Carolina gold ores with equally good results.

Probably no metal is more difficult to extract electrolytically than zinc. It will persist in coming down in a spongy form, and no amount of care seems to stop this, for it invariably commences the moment the deposit attains an appreciable thickness. In the case of lead this spongy deposit does not greatly interfere, as the mass can easily be melted and cast into pigs; but the spongy zinc absolutely refuses to melt.

Each particle apparently becomes coated with a film of oxide, and this effectually prevents their fusing together. This spongy zinc oxidises so easily that if immersed in water it slowly decomposes it, with evolution of hydrogen; and another curious fact about it is that it will take fire spontaneously if exposed to the atmosphere after it has been dried by pressure between filter papers or a few folds of cloth.

From time to time reports are heard to the effect that the manufacture of iron will shortly be carried out in electric furnaces, but the absurdity of such statements is apparent to anyone with any knowledge of electro-metallurgy. Iron is so cheap that an electrolytic process could never begin to compete with the old blast furnace.

The subject of electrolysis on a large scale is an entirely new one.

Electrolytic methods for separating metals have been in use for many years in laboratories, and now that the developments of electrical machinery have made it possible to produce enormous quantities of electricity at small costs, a new order of things has arisen and a new scientific field is opened to investigation.

So far we only see dimly the possibilities of this new agent and for many years the failures will be many and the successes few; but enough is already known to make it safe to say that electro-metallurgy is the metallurgy of the future.

The experimental stage, is, however, being pushed forward as rapidly as possible, notably in the treatment of copper ores; but as we have already indicated, electrolysis will probably be of equal value in the treatment of silver-lead ores and in the separation of copper and nickel.

Next to copper and nickel; silver, lead and antimoy will probably be the first metals to be commercially extracted by electrolysis; next to them tin and zinc, but in the treatment of the last two many difficulties are encountered which are not met with in the first mentioned cases.

We are now having built by Messrs. Crompton & Co., a dynamo to give a current of three thousand ampères at a pressure of twenty-five volts; and which will be used in working our electrolytic processes on a manufacturing scale.

We believe that by working in this manner much more certain and reliable results can be obtained than by working on a small scale; this machine will, in fact, supply a sufficiently large plant to give commercial as well as scientific figures.

In a short while we hope to report a successful process for treating silver-lead ores; which we think would be of great value in a mining country like the Kootenay, where water power is so abundant and so easily developed.

DISCUSSION.

Capt. Adams expressed regret that the author was not present. He invited discussion; and

Prof. C. Gordon Richardson, (Toronto) said:—There are many questions in relation to the treatment of nickel and copper mattes by electrolytic methods, that I should have wished to put to the author himself had he been present. The question of treating such mattes electrolytically is one, I think, agitating all those who handle such mattes. The trouble pointed out by Mr. Gibbs in his paper of the iron entering into the electrolyte, is in my opinion, of minor importance. I think that even in the case of ordinary mattes obtained in the furnace treatment, excellent results could be obtained by precipitating first, copper, and allowing the iron and nickel to go into solution; and then peroxidizing the iron by any of the usual methods and precipitating it, leaving the nickel solution to be treated by any of the ordinary methods for separation. It is a pity, I think, that Mr. Gibbs did not give us in his paper, some figures in regard to the practical cost of separating the different metals in the mattes by electrolytics.

DR. RAYMOND—Mr. President, my attention has been attracted to one or two points in this paper, and in the first place to the statement at the very outset, that the electric process by which aluminium is now produced could not be fairly described as electrolytic. That statement is true as applied to the Cowles process; it is true in that process, as Mr. Gibbs has stated in his paper, that the reduction of alumina is performed at a very high temperature and in the presence of carbon, and may fairly be called an ordinary reduction by smelting; but that is by no means the case in the Hall process, which is the successful process in the States by which aluminium is now manufactured in large quantities, on a working scale, by which the price of aluminium has been brought down to about 50 cents a pound. The current is not over five to eight volts. The heat is very low. There is no way of interpreting it as a reduction by heat or a reduction by carbon. There is a bath of double chloride and fluoride. In that bath pure alumina is reduced. The bath remains practically unaltered. So I should object to Mr. Gibbs' statement that there was no electrolyte process for reducing aluminium, although it is true there is no successful process for its electrolyte reduction from an aqueous solution of any of its salts. It is true, as he says, that we have not succeeded in making an electrolytic reduction of base bullion, (silver and lead). It was tried many years ago by Mr. Keith, and our best metallurgists do not like it; they do not think it is equal to other methods of refining. What surprises me is that Mr. Gibbs should think that he could do better with silver combined with galena than with silver and lead; for if he starts from the proposition that he cannot handle base bullion, then I do not understand how he gets any encouragement about the ores. When he says he can do it with pure galena, I am reminded that he will not get pure galena in practice, but must handle galena with zinc blende and pyrites and a great many others disagreeable ingredients.

MR. GARRISON—I do not agree with Mr. Gibbs; for while it is excellent for many special puposes, more particularly the refining of metals, its application to raw ores is attended with many serious difficulties, which I doubt it is possible to overcome. Furthermore, the resources of thermo-metallurgy have been by no means exhausted. The subject of thermo-chemistry, which is the true basis of furnace metallurgy, has been very slightly studied. It therefore contains great possibilities, of which we can form but little idea. A case in point, I will take the liberty of saying, was the substance of a paper read by me yesterday before the American Institute of Mining Engineers, upon the production of metallic manganese free from carbon, in which the metal alumina is used as a reducing agent. Heretofore, carbon in the form of coke, coal or gas has been our sole reducing agent. It is therefore possible that other reducing agents may be discovered which will in a measure replace carbon. Of course it should be understood that we will probably never have any agents with which to reduce ores from their raw state to com pare in cheapness with carbon.

Mr. Franchot—I have nothing to say about the paper. I am verd sorry Mr. Gibbs is not here to-night; but he is in Ottawa, and he will be here to-morrow; when I will make it my business to hand him over to the tender mercies of the gentlemen, and I will pick up the pieces and carry them home.

Mr. W. Hamilton Merritt—The discussion has gone upon reducing agents. This is a matter of very great importance to us here. In our Lake of the Woods district and the Madoc district we have very refractory ores. If they could be used as has been done in Montana, and I believe, Colorado, in making use of the pyrites and the sulphur as a reducing agent, and the iron too, to some extent, it would be extremely valuable. If any of our American friends, who happen to be thoroughly conversant with sulphur and pyrites as a reducing agent, could give us a few notes on that, it would, I say, be extremely valuable with regard to our local refractory ores existing in the districts I have mentioned.

Mr. Garrison—I would say that I have been occupied in defining two reducing agents. We did not discover the fact that aluminium was a reducing agent; but merely took advantage of a well known chemical fact and used it. We did the same thing with silicon. Previously the only use to which sulphur had been put was to generate the heat in roasting the ores. I should be happy to examine some of that ore referred to for the gentleman in the future, and if we could add still another reducing agent to our list we should be more than gratified.

Prof. Richardson—In speaking of reducing agents, I find myself somewhat at sea when brought in contact with silicon and aluminium as reducing agents. The question to practical metallurgists is: What is the cheapest reducing agent? I do not think that we will be able to able to supplant carbon, except in special cases; for in the first place we have to reduce silica or aluminium before you can use it in its turn as a reducing agent. Sulphur has been suggested as a reducing agent by the English metallurgist, Barks, in a process for which he has obtained a patent in England and other countries. This applies to the reduction of nickel silicates in the new Caledonian ores, by the addition of sulphur or compounds capable of giving up sulphur to the nickel ores; and the metal is precipitated as nickel sulphide in the form of matte.

Dr. Raymond—The question that the gentleman on my right asked had reference I suppose to the pyritic smelting which has been carried on in Montana and Colorado; and so far as the last speaker's remark is concerned, I, perhaps, as the secretary of the American Institute of Mining Engineers, should come to the rescue of my friend, Mr. Garrison, and say that his use of aluminium is for the manufacture of metallic manganese, in which they want to keep the carbon out. So far as pyritic smelting is concerned, I don't believe we can consider that sulphur plays any reducing part, for it takes no oxygen from any ores. We reduce the ordinary pyrites to a lower sulphide, take out part of the sulphur, and by burning that, melt the rest, and get up heat enough to flux the earthy impurities by adding quartz. You cannot do that unless the ores will permit. The thermal calculations show a very narrow margin, so narrow that it is considered necessary to have an outside means of heating the blast. With a blast heated outside with an independent source of heat, pyritic ores of a certain quality can be matted, and the earthy impurities fluxed off at the same time, and all without putting any fuel in the furnace. Half of the sulphur that is in the ore acts as fuel. The process, I believe, is now running in Colorado and Montana, and the company has established a headquarters in San Francisco, and is now engaged in hunting up pyritic mines that suit the process. It is not suited to replace our ordinary methods of roasting and smelting ores containing lead.

NOTES ON A RECENT VISIT TO WEST KOOTENAY, B.C.

By Capt. R. C. Adams, Montreal.

As the title implies, this paper consists of notes upon a visit and not notes upon West Kootenay. By the selection of this theme I am relieved from the necessity of repeating the geological descriptions which will be found in the reports of Dr. George Dawson, or the account of recent developments which has been given in so interesting a manner by Mr. Charles F. Lain in the last number of the *Canadian Mining and Mechanical Review*. All who are concerned will find in print full information upon these subjects from the best authorities. All I need say is that in the district of West Kootenay many discoveries of silver-bearing ores and some of gold have been made, and that each year a new region is opened claiming to be richer than the last. Nelson, where the famous Silver King mine was opened up and one and a half millions worth of ore proved to be in sight. Next the Hot Springs, or Ainsworth district, showed its treasures. After this the Slocan revealed large deposits of high grade ores, and no sooner were these being developed than news came from the Lardo of great finds; and reports from other districts show that over a large extent of country there exists a profusion of veins of argentiferous galena so great in quantity and high in quality that the people predict Kootenay will become the great silver producing region of the world.

As one approaches the district he meets the outlying prospector, who informs him that a visit to the wilds in the Kootenay is needless, as he owns the best claims yet discovered and owing to necessity will sell them for a song, only a few thousand dollars. But pushing on to Nelson, more prospectors are met who have more of the very best claims at still lower prices, and the real estate man tells you that the way to get rich is to buy town lots, proving his case by the information that a corner lot in Nelson, bought four years ago for $100 has just been sold for $4,000. In the month of March last I arrived at the town-site of Kaslo, where lots could be had for $50 to $100, the town then consisting of two houses, an unfinished store and numerous tree stumps. But in

October I found there more than 50 houses; the $50 lots have become worth $500, and there are rumors of corner lots being sold for $3,000.

Kaslo is the western gate to the Slocan region, and a trail of thirty miles leads to the trail up Carpenter Creek from New Denver and along this stretch of forty miles, but chiefly in the middle twenty miles, lie the many "bonanzas." Hiring a cayeuse, that you are assured will not buck, but who terrifies you with what are said to be "playful antics" when you first mount, you slowly walk the animal along the rocky trail through the dense forest, where pines and cedars in interminable procession rear their stately forms. One needs a steady head to ride along the edge of the sheer precipices sloping away for a thousand feet and confidence is not increased by seeing below the dead carcase of a horse that the day before by one false step rolled down to destruction. But some assurance is gained upon meeting a horse that the pack-driver tells you rolled over and over for 300 feet down a slope that day, with 250 pounds on his back; and the only record is a cut on the mouth that gives to his face the expression of a self-satisfied smile, as of one who is proud to have done what few cayeuses have ever lived to hear told. At night one is glad to find shelter in a log cabin; but with potatoes at ten cents a pound and hay at $60 a ton, rations are limited for both man and beast. The pony is left to browse on the leaves and shrubs, and the man is treated to bannocks, pork and beans and tea. The next morning a start is made on foot up the sides of a mountain whose head pierces the clouds at an elevation of 7000 feet. Many weary hours are spent slowly climbing by the so-called trail, across which the great fallen trees lie as barriers or sometimes serve as dizzy bridges across deep ravines, whose rocks promise death for a slip. A plant called Devil's Club grows profusely through the underbrush and if the barbed thorns enter the flesh there will be sorry time before they get out. Toward night the summit is reached and after the bannock is baked in the frying pan before the log fire and the beans are boiled, the bacon fried, the miners and visitor satisfy their hunger and exchange reports of mineral wonders for the news of the outside world. Four men sleep side by side on firboughs in a tent six feet wide, and in the morning in a cold rain they start out to see the prospect. A snow slide has cleared the ground and down this ravine runs a vein ten to forty feet wide streaked with seams of galena, varying from two feet to a few inches in width, but so plentiful that the whole mass would concentrate one half mineral. Tracing this vein over an exposure of 400 feet, the summit is climbed and descent made down the other side to where a cross cut has revealed a solid vein of galena three feet in width, and the belief is expressed that the ore runs all through the mountain from one side to the other and "there's millions in it." Descending the mountain the smooth shoes of the tenderfoot slip upon the wet surface; many falls are experienced and the quick firm grasp of a miner only saves him from rolling down the gully.

In other locations strong veins are seen; and the great galena boulder of 66 tons that has rolled down the mountain from the vein above. Assays are reported giving from $50 to $10,000 to the ton and an examination of an assayer's book at New Denver shows that 260 assays, varying from a trace to 1,500 ounces, gave an average value of 250 ounces of silver per ton.

In the latter part of the fall a wagon road has been built from Kaslo, some twenty miles, and will be extended in the spring, and the railroad is soon expected to follow. Although it now costs $75 per ton to mine and ship ore to the U. S. smelters it is believed that the cost will be redced to $20, and if the ore average for silver and lead a value of $150 per ton as has so far been proved and the smelting charges are not over $20, there will remain a profit of over $100 per ton, and if the output is from 10 to 15 tons a day the returns will soon build up fortunes. Miners "ifs" are proverbially uncertain and if the veins prove small and do not go down, and silver does go down in the market and capital is discouraged from providing transportation, the one ton daily sent down the mountain on ponies' backs and costing over $100 to market, will only serve to buy another tombstone for a broken hearted "busted miner." Some scholarly young men from the School of Mines declare that the minerals will not be found at depths, and hundreds of good prospectors from Montana and Idaho found nothing on the surface and went away disappointed. But numerous diligent seekers have been rewarded and many of the men met with on the trail or in the "half-way" cabins at night pull out of their pockets fine specimens and tell of the great veins of rich ore that exist on the claims they have located.

A careful study of the Kootenay district, during two visits the past year, convinces me that while many of the mineral grades are narrow, pockety, and of low grade, there are enough that are wide, continuous, and of high grade to ensure a large output of good value. For a mining region the possibilities for transportation are exceptionally good. The Slocan mines lie midway between the two systems of water carriage, on the Arrow and Kootenay lakes. Wire cables (aerial tramways) can bring the ores to the valleys, and wagons, tramways or railways can take them to the water, and later on direct by land to the smelters. Nature has done her part in bestowing upon British Columbia great stores of mineral wealth, and providing the routes for transport. A great and speedy development may take place, which will greatly add to the prosperity of the country, and the wealth of many individuals, could man follow nature's leadings and permit industry to pursue its intelligent bent unhampered by the fetters of fiscal laws and special privileges. Nine-tenths of all the people working in the dtstrict are from the United States. Nearly all the capital is supplied from that quarter. The best mining machinery is made in Chicago and San Francisco. The mine owners naturally wish to buy the supplies with which they are familiar and make their purchases in their own country. Numbers of smelters have been built in Montana and Washington, and these want the lead ores to use as fluxes with the dry ores from other localities, and can afford to work them at low prices on account of their desirable character. All parties wish to see railroad communication established with the south, and they see that this is essential to the growth of the district. Three great factors are left for man to provide to supplement nature's bounty and realize the vast treasure of wealth now locked up in the massive and inaccessible mountains. These are mining supplies, smelting facilities and railway transport. But what do we see? Incredible sight in a so-called age of freedom in the end of the 19th century on the continent of America, liberty's vaunted birthplace. Three officials, each wearing a badge labelled "Patriotism," stand at the boundary line and by their exactions paralyze the efforts of the earnest and enterprising workers. The first official seizes the mining supplies and demands one-third of their value in the name of the Crown. The second official stops the ore and says that his Uncle Sam must have $30 a ton on all the lead. The third official says all Canadian products must be moved through Canada by Canadian railways; no transport facilities to the south must be permitted. So timid capital hangs back, and the country languishes waiting for a brighter day and a wiser generation, when industry will not be taxed and men will cease to hinder the worthy efforts of their fellows.

The Canadian Government, seeing in some measure the injury of the tariff to the mining industry, has allowed free entry of mining machinery of a kind not made in Canada. But most of the ordinary articles are made in some fashion in Canada, or else some village blacksmith will pretend to make them, and the concession is of doubtful value. The smelters of the United States are demanding free lead, for they see capital going to build rival smelters in Mexico and Canada. In this case both countries are injured by the restriction, for although a quarter of a million of New York capital has been expended in building a smelter in the Kootenay, the facilities of the United States' smelters are also needed. Owing to a policy which never permits railways nor builds them, a great district, in which the population has increased five-fold within a year, has been left during the winter without communication except by a horse-trail for sixty miles in one direction, and long sleigh roads in another. Serious fears of famine have been entertained, and the development of the country has been seriously retarded by the difficulty of ingress and egress.

But indefatigable men are triumphing over both natural obstacles and human opposition, and a railway from the south will be completed to Nelson this year. If further hindrance to transport ceases, and if the Governments of the United States and Canada will remove their duties upon minerals and mining supplies, a future for British Columbia will open, surpassing the fondest hopes of those who first bound her in the family bonds of Canadian unity. But it is wise to say and give warning, and that without any reference to party politics, that unless the cry of British Columbia workers, "hands off," is heeded, there will be likely to come a breaking of the nominal tie that binds that country to her eastern relatives two thousand miles away, and she will affiliate in name, as nature has destined her to do in fact, with the populous and prosperous regions that adjoin her to the south.

But let us hope that wisdom and justice joined to that love of freedom which is the strongest sentiment in the Anglo-Saxon breast, be it under the Union Jack or the Stars and Stripes, may so determine the course of both nations that human effort may be unhindered, and the wealth of British Columbia's mountains may make glad the whole continent of Columbia.

THE MANUFACTURE OF CHARCOAL IRON FROM THE BOG AND LAKE ORES OF THREE RIVERS DISTRICT.

By P. H. Griffin, M.E., Buffalo, N.Y.

The manufacture of iron in the Province of Quebec forms one of the most interesting subjects in the development of this great industry in America. Its inception followed in a comparatively short period after the first steps taken in the New England colonies, where iron was first practically made in America. In both cases the ores smelted were what are known as "Bog Ores." In Quebec the first work was done in and about the town of Three Rivers, and many interesting facts in connection with the development of this industry may be found in the paper read by Mr. James Herbert Bartlett, of Montreal, before the Halifax meeting of this institution in September, 1885. In that paper Mr. Bartlett traces the industry from its first inception, about the year 1730, down to the condition in which it existed in the year 1883, at which time he stated that the St. Maurice forge was the oldest active furnace on the American continent.

A few years after the date last named we became interested in the matter, and have carried it forward on more extended lines than any before attempted, and in fact, so far as the manufacture of this particular class of iron is concerned, it has never been attempted on the scale we are carrying on to-day. This work is not being done on any experimental basis, but so far has been carried on for the purpose of supplying a grade of iron hitherto procurable only at heavy cost for Canadian consumption from the United States, and for English consumption from Sweden.

The manufacture of iron in the Province of Quebec was carried on entirely with the use of bog ores during the period referred to, and as the supply of iron made elsewhere from cheaper ores became more abundant, the local manufacture, handicapped by want of shipping facilities, lack of capital, and other such natural causes, was gradually discontinued. It was always admitted that for certain purposes the iron made in the province possessed special value, but the demand for articles requiring such special virtue was limited, and cheaper grades were gradually substituted for general manufactures. That iron of the special character of that produced from the bog ores of the Three Rivers district has been for many years the most important industry in Sweden will be referred to later on in this paper, as well as the present condition of its manufacture in that country, and the uses to which it is now put.

Some years ago we were induced to test in our car wheel shops at Lachine and St. Thomas a quantity of Cauadian charcoal iron, the product of an antiquated stone stack situated at the village of Fermont, or Radnor Forges, Champlain Co., Que. We were told that this iron was made from the bog and lake ores of the Three Rivers district, celebrated in the history of the Canadian iron industry, and that it had peculiar merits in strengthening mixtures for car wheels and other high class castings. At that time we were using largely "Selected Salisbury" charcoal iron imported at a very heavy cost from the United States. We were loath to make any change in our mixtures, as we had always pursued a most conservative course in the selection of iron entering into our wheels, but we finally decided to enter upon a series of careful tests with Three Rivers Canadian iron. Several trials proved that it was an iron of undoubted merit, which if the ore and wood supplies of the district warranted, could and should be made in large quantities, not alone to the advantage of the parties operating the furnace, but to the advantage of every consumer of iron in Canada who required castings of special quality, and certainly to the great gain of the Province and Dominion. We found the iron soft, tough, clean, close in texture and with fine chilling qualities—the higher grades admirably adapted for the manufacture of chilled car wheels, the medium grades for castings requiring great strength, and the lower grades soft enough for the finest stove work. To give some idea of the strength shown in these tests we give the following result of the experiments made by us:

The basis of strength on first-class standard car wheel mixtures is expressed by a strength of 50,000 pounds per square inch transverse strength, obtained from a bar 1 in. x 12 in., the bar being supported on the extreme ends. By the introduction of 33 per cent. of Three Rivers iron into our car wheel mixtures we were able to secure a strength of 65,000 pounds without difficulty. It was impossible, however, to procure any considerable or regular supply of the iron, the capacity of the old Radnor furnace being very limited and its operation irregular.

We did not at that time think it possible to develop the manufacture of any great quantity of this special kind of iron, but we did prove to our satisfaction that with proper arrangements a considerable quantity, say 3,000 to 5,000 tons, could be made annually with every prospect of the maintenance of this product for many years. Later work has developed the fact that this particular iron can be made in very much larger quantities, probably sufficient for any demand that may be made. The reason for this will be stated later on.

The results obtained from the tests referred to led us to make a thorough investigation with the view of determining the extent of the ore deposits in the Three Rivers district and vicinity, and to find just what dependence could be placed upon the supply of wood for charcoal making. Our investigations were satisfactory and in August, 1889, we pruched the entire plant and lands of the company, including the village of Fermont or Radnor Forges, situated on the Piles Branch of the C. P. Railway, a village of some sixty houses, with a population of 350 to 400 people. Also a large property at the town of Grandes Piles, with lands on both sides of the St. Maurice River, giving us control of the great water power of the Grandes Piles Falls. The River St. Maurice is navigable for 70 miles above Grandes Piles, and drains, with its branches, a country some 200,000 square miles in extent. This country is covered with the finest timber for charcoal making and with invaluable beds of bog and natural ores. The purchase also included the Three Rivers property, situated on the St. Lawrence River, with railroad and dockage facilities for further use. There was also purchased and leased a large amount of other property for use in obtaining ores and other supplies needed for the manufacture of pig iron. Further investigations were at once commenced in all directions looking to the supply of ore to be depended on, and about one year was spent in prosecuting this work, making leases and purchases to secure the company in its further development. During this period the old furnace was operated with such improvements as could be made upon it, for the puprose of ascertaining further by our own practice the possibilities of the metal. In the meantime arrangements for the supply of ore, wood, etc., had progressed to the point where the erection of a new furnace of large capacity and improved construction could be undertaken. In the early stages of the work it was contemplated to erect a furnace of twenty to twenty-five tons capacity at Radnor Forges for the manufacture of this special iron, but the possible supply of raw materials proved to be so much larger than anticipated that a larger furnace was decided upon and plans were made for one of fifty tons daily capacity. A furnace giving this product is quite a small affair compared with the great furnaces running on common ores throughout the world, but it must be remembered that the product is of a special class and the development of this particular work was of necessity conducted on moderate lines. As it is, a charcoal furnace running exclusively on bog ores, turning out fifty tons of metal per day, is a thing not to be found elsewhere in the world, if my information on these matters is correct. As the operation of such a furnace on the particular kind of ores referred to is a novelty in this day, some facts on the bog ore supply, its distribution and characteristics, and of the metal made from them, will be of interest.

The manufacture of iron from bog ores has been carried on for many years in Sweden, and the bar iron and steel made from it needs no comment or praise. Swedish bar iron is known the world over, and Swedish pig is the base of nearly all the famous steels made in England and other countries. Of late years there has been a falling off in the quality of Swedish pig iron, and English makers have in vain offered higher prices for the quality furnished them in the past. Reliable authorities ascribe this deterioration to the gradual increase in the output of Swedish furnaces and to the introduction of common ores to that end. Whether it is possible to found in Canada an industry that will produce an iron equal to the old Swedish or not, is the question, and to this end a consideration of the supply of bog ores is most pertinent.

Bog ores are found in nearly all countries to a greater or less extent, but they do not often exist in quantities sufficient to make their working practical. As stated, Swedish iron has been largely made from them for many years, and no doubt the supply of the ores is growing limited in that country. The quantity of bog ores that exists in Quebec is difficult to even estimate in definite figures, but the investigations that have been made, and the very thorough ones that we have made, prove its existence in immense quantities. All the bog ore used up to our working was taken from the country immediately surrounding the furnaces, not exceeding a range of three or four miles from the centre. We find it entirely practical to take ore over a range of 75 to 100 miles by establishing depots for the accumulation of stocks from which shipments can be made by rail in large quantities. In treating of the source, growth and quantity of bog ore in Quebec, it may be stated that the district to which allusion will be made may roughly be said to extend from north-east of Quebec city to west of Ottawa, a distance of, say, 400 miles long by 40 to 60 miles deep. Bog ore is found throughout a much wider range, however. The northern limit of this district is the Laurentide Range of Mountains and throughout the whole of this range iron ore seems to exist, generally mixed with the rock. The general formation is such that it favours strongly the natural forces, weather, etc., in the disintegration, and its reduction by attrition. The latter produces principally the fine iron sand found not only along all the river beds, but in fact throughout the entire formation, sand or clay, of this and adjacent counties, and to this attrition, without doubt, the immense iron sand deposits of Moisic and the lower St. Lawrence are due. Owing to the presence of titanium—which exists more or less in all Laurentian ore—this sand seems to possess the peculiar properties of resisting disintegration by natural decay, to which many other ores seem liable.

Beds of hard bog ore are invariably found on hill sides above which swamps or marshes exist, or in runs which lead to or from these swamps. Wherever this dark swamp water flows sluggishly, and especially where swamp moss, fine grass or decayed vegetable matter exists, it will gradually form a light film with every appearance of that caused by oil, which gradually becomes thicker and sinks to the bottom in some quiet spot, where it takes a yellowish and slightly rusty tinge. This gradually becomes thicker and when the water becomes lower in the dry summer, it becomes denser and either sinks lower to the firmer beds below the grass, or hardens and becomes bog ore. One very large deposit of soft ore entirely filled a deep ravine leading from an immense swamp. This ravine was being drained with a view of removing the ore for the purpose of making metallic paint. To all appearance it was simply a dark muck, yet contained, on analysis, over 45 per cent. of oxide of iron. As the top became dry it caked and broke, the top crust showing as clean, black and brilliant a fracture as the best hard bog ore. This proved that the immense beds of soft ore—known as paint ore—known to exist throughout our swamps, will, when drained from natural or artificial causes, become more perfect, dry up and take the form of hard bog ore beds. Some beds of ore when the top layer was removed exposed a heavy bed of soft ore beneath. This being uncovered and exposed to the action of the sun for a time, became so hard that it required heavy work with a pick to remove it. In the particular section alluded to many of the beds are soft on top and harder beneath, while others are the reverse. This would plainly indicate that in midsummer the water in the small swamps becomes so low that the ore deposited in the run-ways and during high water when the swamps overflow, had time to harden. In some, apparently, the water when again high, overflowed the old hard ore and deposited more ore on top, while in others it found an exit by oozing out beneath and leaving an additional deposit below.

The ground on which bog ore will, or has been formed, applies to all marshes or hill sides between the mountain ranges and the river bottoms into which the water finally finds its way. Much land on which ore is found is to-day comparatively dry, owing to the drainage from natural or artificial causes, but a glance at the surrounding country will show that the ground was once the natural drain-way from higher lands. On such places as these the ore is, as a rule, massive and hard.

Once the foundation of a bed of ore is formed it seems to grow more rapidly, partly on account of its affinity or power to draw the iron which is suspended in the water, as the following facts will demonstrate: The Riviere au Lard, from which we obtain our water power, as well as water supply for the furnace and boiler, etc., takes its rise in "Grand Ple," or swamp, in the midst of which lies Lac-a-la-Tortue. This water at all times is dark and rusty in appearance, and a piece of iron suspended or allowed to lie in its bottom rapidly becomes heavily beaded to the depth of an eighth to a quarter of an inch with a pure deposit of iron ore, and this without corroding the iron. Besides, ore in this shape will accumulate in all our supply pipes in the same manner, no matter how rapid the flow may be. This at one time was a source of considerable anxiety, but latterly, as the pipes remained longer in use these deposits appear to attain a certain size and lose their power of adhesion. A blow from the hammer will liberate the heavier and clean the pipe fairly well.

Bog ore, as a rule, is found twelve to eighteen inches below the surface. This season, however, we are getting ore at a depth of four feet six inches, and the beds are heavy, thick and good, apparently of old formation. Ore has been raised from a depth of eight feet in the "Grand Ple," and although this immense swamp is covered with a soft floating top, pockets of small-sized ore have been found in paying quantities on the surface. These facts, taken in connection with the deposits of so-called paint ore in this swamp, lead us to anticipate the discovery of large bodies of ore in the bottom, explorations for which we intend to push during the coming season. Excavations to a depth of ten, twelve and fifteen feet, in the immediate vicinity of Radnor, show as strong indications of ore at the bottom as at the top.

Lac-a-la-Tortue—This lies in the midst of an immense swamp, "Grand Ple," and to all appearance it is the last remnant of what, at one time, was a lake which included the entire surrounding swamp, but one that probably never was very deep, hence its gradual filling in from natural causes. Besides three small creeks flowing into the lake—very sluggishly—the water oozes in around the shores, which are very low. Soft ore is found throughout the surrounding swamp, and in small patches, on the top of what is apparently a floating beaver meadow, hard ore is found. The entire bottom of the lake is more or less covered with ore, but the richest deposits are immediately opposite, or around the mouths of the various creeks. In some places the ore is too heavy foı our dredge, and an attack on it generally results in broken chains and buckets. The only portion of the lake thoroughly worked in the past is Sturgeon Bay; the principal creek enters this bay. Its extent at the widest part is not over 2,000 yards and length about the same. For thirty years this bay has been worked by hand and dredge, and time and again declared to be worked out, and yet this season our dredge hardly stirred from it, and made more than double the ore ever taken from it in one season before. This will give some idea of the extreme richness and rapidity with which the ore is formed. It is hardly possible to estimate the quantity of the ore in existence in this lake, as without doubt it is growing steadily. An experiment was made one year ago (1891) in Sturgeon Bay. The dredge frame was allowed to work down into the mud for six feet, at which depth it brought up a fine dark ore, not quite so hard as the surface, and instead of flat cakes, like the latter, it was small and round, similar to gravel in size, but softer, yet as fine an ore in every way. In other parts of the lake heavy massive veins exist several feet thick, and this is the portion which our dredge finds it difficult to work. If necessary, dynamite will have to be used on this. Explorations for ore on the lake shore, where nothing but sand showed on the surface, found heavy cakes over twelve inches below, showing that the old deposits may gradually become covered up.

When we commenced operations we found that, according to popular opinion, even among our best ore makers, and those most conversant with the business generally, there was not sufficient bog ore left in the country to give a constant supply to a ten-ton furnace. Investigations developed the facts that although furnaces have been working at Batiscan, St. Maurice and L'Islet, etc., since 1737, they had drawn almost their entire supply of ore from the immediate vicinity. In no case did they entirely exhaust the supply, except perhaps within a radius of three or four miles around the furnaces. Then again these furnaces have not been worked steadily, hence steady employment—which alone would produce good explorers—could not be given, and, as a matter of fact, when we commenced operations we did not find a single employee or man who could give us good and reliable information regarding ore fields generally, their knowledge being only of local beds and very superficial.

With regard to the wood supply, there is not a location on the American continent that offers greater inducements for the establishment of a large charcoal iron industry than does the district of Three Rivers. It is not too much to say that the supply of wood suitable for charcoal making, to be had from the banks of the River St. Maurice, and the great territory to the north of that river, is sufficient to keep a number of charcoal iron furnaces in fuel for the next century to come. The St. Maurice is one of the largest tributaries of the St. Lawrence. It takes its rise on the borders of the north-west territories, about 250 miles north-west of the city of Three Rivers, and from thence flows through the Province of Quebec to the outlet at Three Rivers. The tributaries of the St. Maurice are: Shawinigan, Mattawan, Rat, Vermillion, Flammond, Ribbon and Manoran from the west, and Mekinak, Petite and Grand Bostonnais, Croche, Grande Pierriche, Tranche and Wyndigo from the east, these rivers culminating in the St. Maurice, the whole draining a territory of upwards of 200,000 square miles. Throughout its entire course the banks of the St. Maurice river are quite thickly wooded with just the class of wood necessary for the manufacture of the highest class of charcoal, viz., hard maples, beach, birch, ironwood and oak. This wood has been left practically untouched by the lumbermen, who have been working on the river for years past, taking out pine and spruce. The vast territory stretching to the north of the St. Maurice River offers a wide field for the future supplying of wood, and the same applies to the country which the Lower Laurentian railway traverses. Other new railway lines are projected from Three Rivers north, which will open up a new district rich in timber. Altogether the fuel supply is beyond question.

Apart from the bog and lake ore deposits, vast mines of Titanic iron are known to exist in the Laurentain range of mountains, and elsewhere in the Province of Quebec. At the present time these ores cannot be utilized profitably, but science will sooner or later find a means of using these titaniferous ores, not alone with economy, but also I believe with great benefit to the metal into which they enter. The able article of Mr. Auguste J. Rossi, of New York City, read at this meeting, deals exhaustively with the possibilities for the use of these ores, and the data secured by his investigations should prove of the greatest interest to metallurgists.

BOG IRON ORES AND OCHRES OF THE REGION ABOUT THREE RIVERS, QUE.

By A. P. Lowe, B. Ap. Sc. Geological Survey of Canada.

In 1667 bog iron ore was first found in the neighborhood of Three Rivers, and the right to work the deposits was granted in 1676. Little or no work was done towards mining or smelting them until 1733, when a company was formed and forges erected on the west side of the St. Maurice, some eight miles above Three Rivers. In 1743 the forges passed to the Royal domain, and were carried on for several years in the name of the King. Besides other extensive repairs, a walloon hearth was built, and over one hundred and eighty men employed. At the cecession of Canada in 1760, they passed, with other Crown property, to the English Government, and were worked, under the military authorities, for five years, and then transferred to the civil government of Three Rivers. In 1767 they were leased for a term of sixteen years, at an annual rental of £25.

At the expiration of this term in 1783, the forges and land pertaining to them were again leased for another sixteen years for £18 15s. annually. The property subsequently passed through a number of hands, the rental rising to £850 per annum, until in 1845, owing to the dissatisfaction of settlers in the neighborhood, the forges were separated from the lands and sold at public auction, the forges bringing £5,575, while the fiefs St. Etienne and St. Maurice were sold for £4,500 subsequently.

In 1861, owing to various reasons, the Government bought in the lands and re-sold them to the numerous squatters already settled on them. The forges in 1863 became the property of John McDougall & Sons, and were successfully and profitably worked by them until 1883, when operations ceased, as other furnaces had been erected at Radnor, where ore and fuel could more easily be obtained. The ruins of an old forge may be seen on the east side of the Batiscan River, at the head of navigation, near St. Genvievre. This forge has not been in operation since the beginning of the present century.

In the region about Three Rivers, where the bog iron ores and ochres under consideration are found, the valley of the St. Lawrence River is from twenty to sixty miles broad, extending from the Laurentian hills on the north to the highlands of the eastern townships on the south. From the level of the river on both sides, the country rises in a succession of steps and flat terraces, cut out of stratified clays and sands, that here fill up and cover all irregularities of the underlying rocks, to a height of 600 feet above the present level of the river. The otherwise almost level plain is broken by narrow valleys cut by the rivers and small streams of the region. The clays almost underlie the sands, which vary in thickness from a few inches to 100 feet and over. These sands, generally of a distinct yellow color, are charged with a considerable percentage of iron, and from them are derived the numerous deposits of bog iron and ochre that are here found.

The gneisses and basic granites of the archean area to the north of Three Rivers, contain a considerable amount of iron in the form of magnetite or more commonly ilmenite or titaniferous iron ore. It occurs generally in small grains, intimately associated with the other minerals of the rocks, and its presence is so constant as to appear to be a constituent rather than an accessory mineral of the rock. Often the ilmenite occurs in large segregated masses, which are sometimes so abundant as to form the greater part of the rock mass.

Previous to the glacial period the surfaces of these rocks, exposed to the action of the weather, must have been more or less decomposed. During the time of the glacier, the ice moved down from the highlands to the northward, and covered all the country far to the south of the St. Lawrence. In its flow southward the ice not only removed from the archean hills any decomposed material that may have covered them, but rounded, grooved and polished the rocks beneath, by the abrading action of the material carried by the ice and pressure of its mass. The material removed by the glacier was often reduced to a fine state, the quartz to sand, and the feldspars to clay. As a rule this material was not transported far by the ice, being deposited in any place sheltered from the direct action of the moving ice, as in valleys, or behind rocky hills, where the force of the glacier was broken. At or towards the close of the glacial period, the level of the country was about 600 feet lower than at present, and the wide valley of the St. Lawrence was occupied by a deep arm of the sea. Into this was poured the waters of the St. Maurice and other rivers, now falling into the St Lawrence.

Coming from the retreating foot of the glacier these rivers must have been greatly swollen by the water from the melting ice, and with their great volume and strong currents removed much of the finer drift material left by the glacier in the valleys drained by them, and deposited it again in the quiet waters of this arm of the sea. The clay being most easily held in suspension, was carried far out, and was deposited over the entire bottom of the valley, the sands being less finely divided were thrown down along the margin of the old sea bottom.

As the land rose to its present height it remained at the level of each terrace long enough to allow the waves to cut deep faces into the one above, and the sand thus cut down was carried farther out by currents, until finally they nearly everywhere covered the lower clays. The grains of magnetite and ilmenite in the glacial debris were carried along and deposited with the sand. It is to the presence of these more or less decomposed grains that the prevailing yellow color of the sand is due.

The present surface of the greater part of this wide valley is sandy, but, as before stated, the sands are everywhere underlaid by beds of stiff blue clay, impervious to water. As a consequence, in many places where there is little or no slope, a slight uplift of the clay along the front of the wide terraces has rendered the drainage defective, and has formed vast swamps, while the lower portions of the overlying sands have become charged with water. These swamps support a rank growth of vegetable matter, their higher parts being covered with a thick forest, whose roots penetrate deep into the sandy soil.

Decay goes on quickly in these swamps during the summer, and as a result of this decomposition, quantities of organic acids are formed, which remain in solution in the waters of the swamps. These waters coming in contact with the finely divided iron mixed with the sand, the acids reduce the peroxyd to a soluble protoxyd, and it is brought to the surface either as a carbonate of protoxyd, or, when organic matter is abundant, as a combination of protoxyd of iron, with some of those organic matters which have received the names of crenic, geic and humic acids. These protosalts of iron absorbing oxygen from the air, the metal is rendered insoluble, and is precipitated from the solution of the carbonate as a hydrated sesquioxyd, or, from the organic solution, as a compound of this oxyd with the vegetable acid. The bog iron ores consist of variable mixtures of hydrous sesquioxyd of iron with the organic compound, while the ochres are probably the organic compound in a nearly pure state.

The box iron ores occur in patches near the surface of the sandy soil. These patches are from a few square feet to several acres in extent, and from three to thirty inches in thickness. They are always found in or near the borders of the swamps.

These deposits seem to be formed by the ferruginous solution from the swamps, percolating through the adjacent sands, where, coming in contact with the air on the porous soil, the iron is precipitated in the form of concretions about particles of sand. These concretions, covered by successive layers of iron, continue to grow as long as the supply of ferruginous water is kept up. In size they vary from that of small shot to masses several inches in diameter, and when large they have the form of irregular rounded discs, that often show concentric rings of growth.

The region about Three Rivers was carefully examined by Sir William Logan in 1852, and a number of the following localities are mentioned by him in the Geological Survey Report 1852-53.

Many of these deposits have since been worked, and now only afford moderate quantities of fine grained newly formed ore. On the west side of the St. Maurice river, in the augmentation of the township of Caxton, there is a deposit covering about one hundred acres, this locality was worked for a number of years to supply the old St. Maurice forges, and is now nearly exhausted. Northeast of this locality, about four miles, there is a considerable swamp in the fourth range of the fief of St. Etienne, it has an area of about 1,200 acres. Ore is found at uncertain intervals of space along the north-western border of the swamp, and it probably occurs in patches over the greater part of it.

About two miles and a half south-east from this locality, in the second range of St. Etienne, bog ore is met with in patches over a surface from thirty to forty acres. The thickness of the mineral patches in this ground appears to range from six to nine inches. Farther south, in the seigniory of Pointe-du-Lack, there are several localities from which large quantities of ore were once taken, but they are now nearly exhausted.

To the east of the St. Maurice River, and between it and the Batiscan River, are several localities abounding in this mineral. Near the banks of the St. Maurice, about a mile and a half below Pointe-a-la-Hache, there are indications of ore.

To the north-east of this, at a distance of six miles, is a triangular area lying in the St. Felix and Ste. Marguerite ranges, partly in the seigniory of Cap-de-la-Madeline and partly in that of Champlain. Its superfices extends over about six square miles, it has a uniform level about two hundred feet above that of the St. Lawrence. Throughout this neighborhood areas from one-sixteenth to three-quarters of an acre are more or less occupied with patches of ore, from two to four and occasionally six parys across, and from six to ten inches thick.

In the seigniory of Champlain a considerable field of the ore exists on the south side of the Champlain River. It has a breadth of twelve to eighteen acres and its superfices is about 1,100 square acres. There is another band north-west of it, and separated from it about ten acres, this band has an area of about seventy-five square acres.

The ore, as in other instances, is found in these bands in numerous patches, the thickness of which varies from three inches to a foot. From that part of the band which lies in the vicinity of the river A-la-Lime the old forges on the Batiscan River were supplied with ore. On the eastern side of the Batiscan River, bog ore is found on the River Veilette, upwards of a mile and a half from the bend in the Batiscan, below the old forges. It occurs in several patches, one of which extends over a third of an acre, with a thickness of from three to six inches and sometimes a foot. A mile and a half beyond, on the road to St. Prosper, it is found not far from the boundary between the seigniories of Batiscan and St. Anne-de-la Perade, here the patches are small and the thickness does not exceed three or four inches.

In the seigniory of St. Anne-de-la-Perade, indications of ore are met with on the south-west side of the road which turns up from the St. Anne River and runs parallel with the Charest, but the patches do not seem to be numerous, the thickness is from three to four inches.

Lac-a-la-Tortue is situated in the southern part of Radnor, about one mile beyond the north line of the seigniory of Champlain and two miles from the St. Maurice River. The lake is about three miles long from northeast to southwest, and has an average breadth of about one mile. It occupies the lowest depression of a great swamp called Grand Ple that extends north and south from the lake. At its centre the water is under twenty feet deep, and shoals gradually to the shore. By removing an obstruction at the discharge the water has been lowered some six or eight feet, and a wide margin of its bed has been exposed on all sides.

The lake is fed by a number of small streams flowing from the sursounding swamp, these are highly charged with salts of iron, giving the water of the lake a very ferruginous taste, and coloring it a rusty yellow. The ore is found in the form of concretions scattered through the soft greenish mud, for several feet below the surface of the bottom. It appears to be formed by the precipitation of the protosalts in solution, which take up oxygen from the surface, and becoming insoluble, sink to the bottom, where they collect about various particles of foreign matter and form flat porous concretions of various sizes, the largest being often six or eight inches in diameter, by over an inch in thickness, and show distinct rings of growth.

The growth of the ore in the lake bottom is quite rapid, it having been found that paying quantites of ore can be obtained from areas completely exhausted some eight or ten years ago.

Work is carried on by hand in the shallow portions along shore, and in the areas left bare by the lowering of the level of the water. The operation consists in shovelling the mud containing the ore into iron sieves of about thirty inches in diameter, where the ore is washed free from mud and then made into convenient heaps for removal. In the deeper parts of the lake the ore is raised by a dredge with three rows of iron buckets on an endless chain. This dredge is capable of working to a depth of twelve feet, and brings up the ore mixed with soft mud; this is dumped into a long cylindrical sieve, placed on an incline so as to discharge on to scows moored alongside.

Along the axis of the sieve are arranged a number of jets of water, which as the sieve rotates, wash away the mud and allow the clean ore to fall out at the lower end on to the scows. The loaded scows are towed to the west end of the lake where the Pilles Branch Railway passes close to the water, and from there loaded cars are run direct to the furnace at Radnor.

During the past season large deposits of massive ore were discovered in the bottom of the lake which are claimed to be two feet and upwards in thickness, and although work has been carried on here for more than thirty years, the supply of ore last season was much greater than in any former one. The ore was formerly supposed to lie in the mud within a foot or so of the bottom, but this year paying quantities were found in the underlying sands to a depth of six feet, the limit to which the dredge would work. From this it will be seen that the supply of ore in Lac-a-la-Tortue is far from exhausted.

On the south side of the St. Lawrence—opposite Three Rivers, in the second, third and forth ranges of Gentilly, the Canada Iron Furnace Company have discovered and are working a number of remarkably rich beds of ore. These are generally found along the faces of the terraces. The largest bed is about ten acres long by half an acre wide. Work here has been carried on to the depth of four feet without reaching the bottom of the bed, which will reach five or six feet in places. The ore on top is fine, but towards the bottom it becomes heavy and massive and has to be broken out by picks.

Medium sized patches of ore have been found extending over an area of six square miles in this locality and no doubt many others will be found in the neighborhood.

Work has also been carried on by this company in the fourth range of Kildare, County of Joliette, where one patch is three acres long by half an acre wide, with an average thickness of twelve inches, all of fine rich ore. There is a band here that is said to have been traced for a distance of seven miles.

It will thus be seen that although iron has been mined and smelted in the vicinity of Three Rivers for a period of one hundred and seventy years, there yet remains considerable quantities of the ore in the deposits first worked and that new beds of great extent continue to be found containing sufficient ore to supply the larger and newer furnaces for probably as long a time to come.

Ochre—The ochres are found along the courses of small streams flowing from swamps, or in the old beds of small shallow lakes. Near the surface the ochre is generally yellowish-brown, becomming reddish in the parts most exposed to air and light. At a short distance below the surface, however, the color is greenish, and when recently exposed is greenish-white, indicating a compound of protoxyd of iron, which grows yellowish from peroxydation as the mass dries.

The water that oozes from the ochre is at first colorless, transparent and ferruginous in taste, but, by exposure to the air, soon lets fall a reddish-brown precipitate of ochre and becomes tasteless. As the precipitate is buried by subsequent accumulations of the ochre, it is again reduced to a protoxyd, either by the reaction of the organic matter which it contains, or by that derived from the decaying roots and trees which are generally abundant in the deposits, and thus assumes the greenish color already noted.

In some of the deposits there are layers of a brownish-black color, due probably to the presence of manganese; and in some places the whole deposit is made up of this dark colored ochre.

Indications of ochre are seen along with most of the deposits of bog ore, but it also occurs without the presence of the latter, and often in great masses.

The principal deposits in the region under consideration occur on both sides of the St. Maurice River.

A very large ochre bed is situated on the St. Nicholas range of Pointe du Lac. It is crossed by the range road, running north-westward over a mile from the point where this road starts from the river side road. The deposit extends on each side of the road about a quarter of a mile to the south-west and a mile to the north-east, the breadth is irregular, and varies from fifty to eight hundred yards, and the whole area may be about four hundred acres. The thickness of the deposit ranges from six inches to four feet, and may have an average of about eighteen inches. The prevailing colors of the ochre are red and yellow, with bands of a purple tinge, and others of a blackish-brown. Farther to the northwest, on the road of the same range, patches of ochre occur in considerable abundance for upwards of a mile; but are not so pure or thick as the great one just described.

About a mile and a half below the old St. Maurice forges, but on the opposite side of the river, a patch of ochre is found associated with the bog ore there. It has an area of about 200 square yards, and is from three to six inches thick, and of exceptional quality.

On the north-west side of that part of the road through the St. Marguerite range, which runs south-west of the River-au-Lard, small patches of yellow and brown ochres are met with for a distance of six miles. They all contain more or less sand, and rarely exceed four inches in thickness.

In the St. Malo range of the seigniory of Cap de la Madeleine a great deposit of ochres occurs opposite to the end of the road which turns up from the margin of the St. Lawrence, about two miles below the Cap de la Madeleine Church. The locality is about half a mile from the front of the St. Malo range, and about a quarter of a mile north of the C. P. Railway. Its breadth on a line continued from the road is about six hundred yards, and it extends rather more to the north-east than to the south-west, with a total length of about two miles, and the area is thus upwards of six hundred acres.

Two openings on adjoining lots are worked by the St. Maurice Paint Company and the Johnson Paint Company.

The former company have the mining right extending over twenty-one lots. At their present opening the deposit is about five hundred feet wide, and varies from one to twenty feet in thickness, with beds of peat interstratified with the ochre. Small patches of bog ore rest on top and the ochre is of a dark yellow, for from three inches to two feet below the surface ; beneath this the color is a light green, and many stems and roots are present. In places the bands are of a purplish black color, due probably to the presence of manganese.

At the openings of the Johnson Paint Company there is about eighteen inches of peaty matter covering the ore, which is of a light green color, and is worked to a depth of six feet. At both places the ore is burnt on the spot, and thirteen shades of red and brown are produced.

On lot fourteen, in the second range of Radnor, and about half a mile west of St. Tite Junction, large deposits of ochre are worked by the Radnor Paint Company. The ochre is found in two gulleys, which join and descend to the St. Maurice.

The deposit has been proved for a distance of half a mile, and is from 50 to 150 yards wide, and in places fifteen feet thick. The prevailing colors are brownish or purplish black, due probably to manganese.

THE COMPOSITION OF THE BOG AND LAKE ORES USED AT RADNOR FORGES, AND OF THE IRON PRODUCED THEREFROM.

By J. T. DONALD, M.A., Montreal.

The principal ores used at Radnor are the Bog and Lake ores of the district, ores which are smelted with great ease on account of their porous nature and their associated organic matter.

The source of these ores, in a general way, may be said to be the area drained by the St. Maurice and its tributaries. It is well known that water containing organic acids (formed from decaying vegetable matter) takes up in solution more or less of the iron of the rocks over which it flows. When such ferruginous water reaches low swampy regions the iron is gradually deposited as hydrated peroxide. Deposits of bog ores are the sites of former low-lying areas which served as precipitating basins for the iron collected from the adjoining highlands and carried down by the streams. The same process of solution and precipitation is going on to-day and must continue as long as there is iron in the rocks traversed by water containing vegetable acids.

As pointed out by the writers of other papers, bearing on this subject, these ores have been known and worked for many years and occur in deposits of various size extending over a wide area of country. As a consequence of these two circumstances, many analyses have been published, and these show that the ores have a wide range in composition and this is well shown in the quantities of phosphorus and manganese occurring in different bodies of the ore. Dr. Harrington, of McGill College, some time ago informed the writer that in certain of these ores he had found not more than a faint trace of phosphorus. On the other hand I have, in one sample—an extreme case—found as much as nine-tenths of one per cent. of this element. It is much the same in the case of manganese. In the Report of the Geological Survey for the year 1863, there is given the analysis of a certain ore "exploited for the St. Maurice Forges," and in it this element is found in traces only. In some samples recently analysed I have found no less than 22·82 per cent. of manganese. There is nothing very remarkable in this variation in composition. The same is seen elsewhere, for instance, in Nova Scotia, the great iron area of Eastern Canada. A judicious selection is all that is required in order to obtain from the deposits of the Three Rivers district ore that will yield iron of excellent quality. Column I. in the subjoined table is my analysis of a sample representing a large quantity of bog ore selected from various points for the Radnor furnace in December, 1890.

A portion of the ore used at Radnor is known as "Lake Ore." This ore is found on the bottom of Lac-à-la-Tortue, and until the recent discovery of similar deposits in Lac au Sables was the only known extensive deposit in this province, if not in the Dominion. Such lakes ores are quite common in Norway, Sweden and Finland. The Lac-à-la-Tortue ore is very similar to the neighboring bog ores and yet differs from them in certain respects. The former shows concretionary structure to a much greater extent, and curiously enough, analysis shows that in many cases the lake ores contain less water than the bog ores.

Column II. in the table is my analysis made in December, 1890, of a sample representing a large quantity of Lac-à-la-Tortue ore. Column III. is the analysis of an ore from the same lake made by Prof. Carlyle, of McGill College.* Column IV. is an analysis of a lake ore from Flaten Wermland, Sweden, by Svanberg, as cited in Phillips' Metallurgy.

COMPOSITION OF IRON ORE.

	I.	II.	III.	IV.
Ferric oxide	60.74	70.04	69.64	67.59
Ferrous oxide..........	....	.....	0.72	....
Manganic oxide.......	1.18	1.78	2.99	1.45
Alumina	2.59	2.20	2.43	4.18
Lime	3.47	0.32	....	.47
Magnesia	0.93	0.27	0.60	.23
Phosphoric anhydride.....	0.69	0.76	0.47	.18
Sulphuric anhydride	0.19	0.23	0.09	....
Silica..........	13.94	7.84	8.17	7.81
Loss on ignition....	16.49	16.84	15.00	17.81
	100.22	100.28	100.11	99.72
Metallic iron	42.52	49.03	49.31	47.32
Phosphorus.............	0.302	0.331	0.205	.081
Sulphur.................	0.078	0.093	0.036	....

The paper which Mr. Griffin has read has dealt largely with the iron produced at Radnor. It will suffice for me to cite the following analysis of Radnor iron to show the nature of the metal in so far as the influence of the ore is concerned. The sample analyzed was of grade No. 1½, and the analysis was made by me in May, 1892.

ANALYSIS OF RADNOR IRON NO. 1½.

Iron	93.52
Carbon....................................	.701
Graphite	3.256
Silicon	1.269
Sulphur	.0406
Phosphorus........................	.6532
Manganese	.557
	99.9968

*Canadian Record of Science, Vol. III., No. 1., p. 43.

NOTES ON THE ECONOMIC MINERALS OF NEW BRUNSWICK.

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By Mr. Wm. McInnes, Ottawa.

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In the following brief notes an attempt is made to gather together some of the facts relating to the economic minerals of New Brunswick, which are scattered through various publications. The principal sources of information have been the Annual Reports of the Geological Survey of Canada and the published papers of Dr. L. W. Bailey, of the University of New Brunswick. The paper has been written, not with the idea of presenting anything new in connection with the subject, but because it seemed desirable that the resources of New Brunswick, in the matter of economic minerals, should not be altogether passed over at a meeting of this sort, held in Canada. New Brunswick has always been rather an agricultural than a mining country, and in natural products, her wealth has been derived from her forests of pine and spruce rather than from her mineral resources. Now that the forests are yielding each year with greater difficulty, a diminishing output of lumber, it is appropriate that attention be called to the known and possible mineral resources which may be looked to as future sources of wealth and revenue A very large area in the central and northern part of the province, constituting its highlands, has been but little explored, chiefly owing to its rugged character and remoteness from the ordinary highways of travel. Indeed of a large part of the district nothing is known beyond the valleys of its larger rivers and consequently of this area nothing can be said, except that its possibilities are very grand and what little we do know of it points to conditions favorable enough for the occurrence in it of valuable minerals. We shall refer to the various minerals in alphabetical order rather than in order of their comparative importance.

Albertite—This very interesting mineral, though now, as far as known localities are concerned, exhausted, merits a passing notice both on account of its high pecuniary value and its, perhaps, unique mode of occurrence. At the time of its discovery near Hillsboro', Albert Co., in 1849, and for many years afterwards, it was popularly looked upon as a true coal. As development work proceeded, however, and the nature of the mineral itself became, from more careful examination, better understood, it became evident that neither in mode of occurrence nor in its nature did it merit the name of coal.

The bituminous shales which occur near the base of the lower carboniferous formation are rich in oil, and from them, with little doubt, the petroleum which filled, in the form of Albertite, veins and fissures in these and neighboring rocks has been discovered. The principal vein, which was worked to a depth of about 1,500 feet, was nearly vertical and presented all the phenomena of a crack or fissure which was subsequently filled with its cotained mineral. Larger and smaller veins were found running off from it and these though sometimes following the lines of bedding of the strata, as frequently cut across them in oblique direction, as the forces which formed the original crevice determined. The mineral itself is black and shining and quite free from any signs of bedding. Its principal use has been as a gas producer mixed with coal of lower gas-producing qualities.

The Albertite yields about 14,500 cubic feet of gas per ton, or about 100 gallons of oil. It is estimated that 200,000 tons have been taken out at the Albert mine since the beginning of operations there, representing a value of probably more than three and a-half millions of dollars. Although exploration, with that object in view, has proved that veins of this mineral occur at various points widely separated along the band of lower carboniferous shales, yet these have nowhere been of sufficient thickness for profitable working. Before the closing of the Albert mine in 1879, every endeavor was made to locate other deposits in the vicinity, but without result. The supply of Albertite may be said to be confined now to hand specimens for mineralogical cabinets.

Bituminous Shales—In this connection may be considered also the shales from which the last mineral has been derived. Though now practically quite out of the question as oil producers owing to the opening of the richer oil regions of the United States, Canada and other countries, they are perhaps from their permanency worth keeping in mind as possible sources of supply in the future. An attempt was made to work them before the opening of the Pennsylvania oil regions, and it was found that they yielded from 30 to 60 gallons of oil to the ton. The total amount of oil contained in these bands is very considerable when we know that they extend in length for about 50 miles and have an average width of about half a mile. The bands are very much twisted and bent, and the strata are usually standing at very high angles. Petroleum has been noticed to ooze from these beds at various points, but never in sufficient quantity to warrant collecting it. Boring at various points has resulted only in showing oil in very small quantities.

Antimony—Antimony in the form of the grey sulphuret or stibnite with some native antimony occurs at Lake George in the parish of Prince William, York County. The locality is about eight or nine miles from the right bank of the St. John River and twenty-five miles from Fredericton. Veins of ~~quartz scatter~~ over a considerable area in this district, which cut hard argillites and feldspathic sandstones of supposed cambro-silurian age, hold stibnite in greater or less quanrities. The enclosing rock of the veins is altered by the probable near approach of intrusive granite which comes to the surface a short distance to the north. The thickness of the veins vary from a few inches to about six feet and the ore is irregularly distributed through them in strings which sometimes attain a thickness of 15 inches. On one of the properties in this neighborhood considerable mining work was done and plant consisting of an engine of 80 horse-power, a steam drill, Blake crusher, jiggers, etc., was introduced and furnaces for smelting, etc., were erected. At first the ore was taken from open cuts along the surface of the vein, but later shafts were sunk and mining was carried on in a more systematic way. Work was discontinued about ten years ago and has not been resumed since.

Coal—The only productive coal area in New Brunswick is that situated in Queen's County, about the head of Grand Lake, and limited quantities are mined here annually for local consumption and on a small scale for export. The product may be described as a bituminous coking coal giving a rather large percentage of ash. It is excellently adapted for black-smiths' use and is used with satisfaction to the consumers as a house coal.

The result of a geological survey of the carboniferous area of New Brunswick has been to show that it is extremely probable that the beds referred to, which occupy such a large area in Queen's County, practically constitute the only seams of coal in the province which can be considered available for practical working. Other beds it is true have been found at various points, but where seen they are nowhere of any great thickness, and as they for the most part occur in what we believe to be the limestone grit, there does not seem to be any good reason to hope that thicker beds will be found. Borings too, though they have not been numerous enough to prove that the lower coal measures may not occur in depression in the underlying rocks, yet they do show that these lower beds are certainly wanting over all those areas where they have been made, and we are warranted in believing that their existence here at all is very doubtful and that if they do occur it can only be in troughs of very limited extent.

The large area covered by the seams which are now worked and their easy accessibility render them well worthy of consideration in reckoning up the available mineral resources of the province.

Though the exaggerated reports of the enormous value of these coal beds which were current some years ago have, with our increase in actual knowledge of the facts, been long discredited, yet there remains the knowledge that we have here a coal field easily accessible and capable of yielding a large amount of coal of good quality. The workable beds have been estimated to contain, if they keep about the same average thickness over the area, over 150,000,000 tons of coal.

Copper—Copper though occuring at many points in southern New Brunswick as a gray sulphuret scattered in lumps and grains through micaceous slates and other altered rocks, and in limited quantities in veins, has not as yet been successfully worked.

Almost all the ores of copper occur in limited quantities in New Brunswick, but none as yet noticed have been of a character which promised remunerative results.

Graphite—Graphite or Plumbago is found in a finely divided slate in many of the highly altered rocks of southern New Brunswick.

It has been found in considerable quantities in rocks of supposed Laurentain age near St. John and has been mined at the falls at the mouth of the St. John River. Mr. Hoffman analyzed a specimen from the locality and found it to contain :—

Graphite carbon	48·775
Rock matter	50·058
Hygroscopic water	1·167

Though this property is admirably situated for development it has never been very successfully worked, owing probably to the graphite not being of a quality suitable for the manufacture of better grade lead pencils. There seems to be a good supply of the mineral and the deposit may yet be profitably worked.

Gypsum—Extensive beds of gypsum occur in the lower carboniferous of southern New Brunswick. The principle producing localities are Hillsboro and Hopewell Hill in Albert County. From these properties large quantities of gypsum both calcined and raw are annually shipped. The beds of gypsum attain a thickness of from 70 to 100 feet, though in some localities part of the bed consists of anhydrate, and cover an extensive tract of country.

These are associated with the limestones of the lower carboniferous and are for the most part white in color, exceedingly pure and of uniform character, though differing in being highly crystalline in some localities and not at all so in others.

In the northern part of the province valuable beds of this mineral occur on the left bank of the Tobique River, about 30 miles from its mouth. The gypsum here occurs as in the southern part of the province associated with the limestones of the lower carboniferous. The beds attain a thickness of about 150 feet. It is made up of impure gypsum varying in color from dull purplish red to greenish, with thin layers which are pure white and fibrous.

Though for many years locally used by the farmers of the district and neighboring State of Maine, it has never been extensively shipped.

The opening of the Tobique Valley Railway will afford facilities for shipment which may extend its market and establish a profitable industry.

Gold—There have been from time to time reported discoveries of gold in various parts of the province, but none of the reported finds has yet led to any practical results.

That gold has been found in the drift at various points admits of little doubt, but whether this has been locally derived or not it is beyond our present knowledge to say. A possible source may be found in the gold Chaudiere district, carried down the valley of the St. Lawrence and thence southward with the ice which has scattered boulders of Laurentain gneiss over the lands south of the height of land.

In favor, however, of its local derivation we have the fact that a series of strata which strongly resembles the gold bearing series of Nova

Scotia, and probably of the same age, crosses the central part of the province and over large areas, has been but little examined. Over the limited areas of which the densely wooded character of the region restricts detailed examination, these slates and sandstones are highly altered. Large areas of intrusive granite invade them at several points and they are in many places cut by numerous veins of quartz. These, as far as our present knowledge goes, are not auriferous. We may hope though that somewhere in the vast unexamined areas the veins may prove to be gold bearing.

Mr. Hinde has recorded washing gold from the depth of the Tobique and some of its tributaries, notably from a brook near Blue Mountain, and many other streams have yielded small amounts.

Iron—Attention was first called to the hematite beds of Carleton county, by Dr. Chas. T. Jackson, of Maine, in 1836. Though ores of iron have been noticed at different points throughout the province, these of Jacksonville above referred to, are the only ones which have been deemed promising enough to warrant development. The hematite here occurs, in association with limonite, in bands of varying width interbedded with green, red and black clay slates and can be traced for a long distance across the country. The containing slates form part of the great line of these rocks of silurian age which extends from this point northwards to, at one place, within nine miles of the St. Lawrence where they overlap the Cambrian of the so-called Quebec group. The thickness of the ore beds varies from a few feet to twelve or more, and they conform to the plication of the enclosing slates which are much contorted. Though the beds when considered as a belt are continuous for long distances, as individual beds they often terminate almost abruptly. The dip is N. W. at an angle of 85 degs. to 90 degs. The ore everywhere holds a percentage of manganese and phosphoric acid, the latter running in some cases so high as to render the iron cold short. An average of six analyses made by John Mitchell, of London, Eng., gave :—

Metallic Iron	35·593
Sulphuric acid	·723
Phosphoric acid	1·298

An analysis of the pig by Mr. Wendt, M.E., gave :—

Phosphorus	1·032
Sulphur	·005
Manganese	3·460

These beds have been used for a number of years, the fuel used being hardwood charcoal, but active operations closed many years ago and it is extremely doubtful if, under existing conditions, they could again be profitably worked. Exploration along the strike of the beds though it has proved the continuance of the iron bearing band for some distance to the north-east and south-west has nowhere reached beds comparable to those of Jacksonville already described.

Bog Iron Ore—Deposits of bog iron ore are known to occur at various points in New Brunswick. One situated in the parish of Burton, Sunbury county, has been worked in connection with the hematite beds of Carleton county. The ore bed consits of a mixture of loamy and peaty material, with a depth of from one to three feet and underlaid by a clayey hard-pan. The ore is found in the form of cakes or loose feathered aggreations, few of them more than 6 to 12 inches in diameter although sometimes occurring as large as 2 to 3 feet. An intervale or alluvial terrace of considerable extent occurs here at a height of about ten or twelve feet above the St. John river and the ore bed occupies a longitudinal belt in it parallel to the river about 50 yards in width and three to four miles in length. The waters which have carried down and deposited the iron flow over rocks of millstone grit of middle carboniferous age and from these it has probably been derived in the first place.

Nickel occurs in pyrrhotite deposits in the county of Charlotte. The deposits are of pyrrhotite and chalcopyrite intimately mixed and closely resemble both in general aspect and, as far as I can learn from conversation with those who have visited the locality, in mode of occurrence, the nickeliferous pyrrhotite deposits of Sudbury. A sample of 72 lbs. weight, which was considered a fair average of the ore, was submitted to Mr. Hoffman, of the Geological Survey of Canada, for analysis, and yielded 1·718 per cent of nickel. As there appears to be extensive deposits of this pyrrhotite the analysis above quoted, though not showing a high percentage, would seem to warrant a more thorough examination of the region. The Sudbury ore is known to vary widely in the proportion of contained nickel and the occurrences here of deposits with percentage high enough for profitable working would seem to be not at all unlikely. As far as can be learned these, like the Sudbury deposits, are not veins, but rather aggregations of the mineral from surrounding strata in pockets and irregular masses at or near the contact of intrusive masses of the trap and altered sandstones and argilites of supposed Cambro-Silurian age.

A specimen from the vicinity of L'Etang in the same county, submitted to Mr. Hoffman for examination seemed to be of quite similar character.

Specimens from the first mentioned locality, which is within three miles of the town of St. Stephen, were examined by Mr. Best, of St. John, who says: "I have found as high as 2·48% of nickel at 19 feet from the surface in pit No. 2." Mr. Best further says:

"Samples were taken at about 17 feet from the surface and a New York chemist finds:

Sulphur	32·93
Iron	56·00
Copper	1·03
Nickel	2·04
Insoluble matter	8·00

with traces of gold and silver."

Manganese—The following notes are condensed largely from the annual report of the Division of Mineral Statistics and Mines of the Geological Survey Department for 1890.

The ores of manganese worked in New Brunswick are chiefly pyrolusite and manganite which occur in limestones near the base of the lower carboniferous formation. The ore is not found in veins, but in irregular beds and pockets, many of which are of considerable extent, as many as 4,000 tons have been extracted from one of these. Attention was first called to the value of these deposits in 1862, when Mr. Davidson, of St. John, commenced work in King's county, about 11 miles south of the town of Sussex. The ore up to a very recent date has been extracted entirely by open cuts and by drifting into the side of the hill. Exploration with the diamond drill has more recently revealed promising bodies of ore, and shafts are being sunk to gain these. Analyses of the Markhamville high class ore gave for three samples tested the following results:

	No. 1.	No. 2.	No. 3.
Manganese binoxide	89·70		
Manganese peroxide		97·21	96·62

with very small percentages of iron, barium, baryta and silver. A well equipped mill for treatment of the ore is in operation at the Markhamville property.

At Jordan Mountain about five miles north of Sussex a very similar deposit has been worked to a similar extent by open cutting and 400 tons or thereabouts of ore has been extracted.

At Quaco Head near St. Martin on the Bay of Fundy, a tunnel has been driven into the perpendicular face of a bluff of calcareous shale, charged with manganite in scattered masses and pockets and a mill is in operation from which the ore after treatment can be readily shipped by water.

Analyses of the ore gave for the pure compact ore 58·20 per cent. of metallic manganese and of the porous ore 57·15 per cent.

In the parish of Elgin, Albert county, a decomposed quantity of supposed pre-Cambrian age has been found to hold manganite and pyrolusite, though whence it has been derived has not been determined. Work has been done on the property and an analysis of a specimen of psilomelane gave of manganese dioxide 50·21 per cent.

Operations were carried on for some years at Shepody Mountain, in Albert county, on a deposit of pyrolusite and psilomelane occurring at the contact of the lower carboniferous strata which make up the mass of the mountain with the underlying older schists, but the works have been long abandoned.

Extensive deposits of wad which analyses have shown to contain an average percentage of manganese binoxide of 47 per cent., are being worked in the parish of Hillsboro', Albert county. They attain a thickness in places of upwards of 40 feet and are covered by only a thin layer of partially decomposed vegetable matter. As the treatment necessary is extremely simple and inexpensive this ore should be extracted and worked at a good profit.

Salt—Salt has for a number of years been made from the brine obtained from natural springs in the vicinity of Sussex. Mr. Chalmers in the annual report of the Geological Survey, Vol. IV., page 91L, says:

"Brine springs occur at Sussex and Salina, King's county, and at Bennets Brook, near Petit Codiac, Westmoreland county. The springs at Sussex are the only ones from which salt is now made. Five or six hundred bushels of salt per annum are manufactured here by the ordinary process of boiling the brine in pans..... The salt prepared at the

Sussex Salt Works, is said to be of a very superior quality for dairy use; but the sale is limited, the consumption being merely local. Several surface springs occur in the vicinity of these salt works, only a few of which have yet been utilized..... The brine at all these places contains a greater or less percentage of sulphate of lime or gypsum," and at page 41A of the same report "a boring 125 feet deep was recently sunk at one of these springs 13 feet of it through surface deposits and 112 feet in rock. The object was to find the salt rock, but nothing of the kind was met with. The strength of the brine, I was informed, increased slightly till the solid rock was reached; beyond that it did not perceptibly change."

Silver—Galena, carrying small percentages of silver, has been noticed in the province, and some preliminary exploration work has been done on several veins, though none have yet been worked. Veins of this character are reported in the Negesigait river, Gloucester county, near Woodstock, Carleton county, and on the Tobique river, Victoria county.

The occurrence of tinstone in connection with the highly altered slates and gneisses of the southern part of Carleton county, where they are invaded by an intrusion of syenite, has been reported by Dr. Gesner by whom a specimen was collected and deposited in the Gesner Museum at St. John. The exact locality is not known but the occurrences of tinstone at Waterville, Me., in rocks of the same age, lends probability to the supposition that it may occur here.

Tripolite—Infusorial earth is known to occur in considerable deposits in many of the lake bottoms of southern New Brunswick. These seem to be of fresh water origin and contain numerous sponge spicules and quantities of broken up natimaceæ. At Fitzgerald Lake, St. John county, a deposit of infusorial earth covers the lake basin to an estimated depth of about 50 feet, covering an area of about 60 acres. Besides making a good polishing powder, certain strata of this deposit have been used successfully for packing purposes as a non-conductor of heat.

Building Stone, etc.—To the list of known valuable minerals given, we may add that the province can furnish in unlimited quantity a great variety of building stones of excellent quality. The sandstones, of carboniferous age, of Westmoreland and Northumberland counties have long been in good demand on account of their durability, color and good dressing qualities. Their use has not been confined to the province itself, but they have for years been extensively exported. In the same set of rocks occur grits or sandstones which make excellent grindstones.

The granites and syenites of the province too have been extensively quarried for local use and for export. Those of St. George, in Charlotte county, have become celebrated for their very beautiful tints, their uniformity of texture and their susceptibility to a high polish. Blocks and columns of very large size and free from flaws are readily obtainable, and as almost any desired tint may be had, they can hardly be surpassed for ornamental building purposes.

The granites at various points along the St. John river have also been extensively quarried, and those of the central granite area, though not widely used, furnish excellent stones.

Limestones are widely distributed and have long been profitably worked along the lower stretches of the St. John river, for building purposes and for calcining.

THE CRAWFORD GOLD MILL.

CAPT. G. MACDUFF, Waverley, N.S.

The history of the Crawford Mill is interesting considering the brief period since the patents were issued, showing as it does a patient and intelligent effort to accomplish a result long desired and of grave importance to the gold producers of the world.

Quietly and unostentatiously it has been developed, and as we believe, proved its ability to extract at one operation and at small cost a large proportion of all the gold contained in ores, whether the same be classed as free or refractory, and to dispense with the cumbrous, complicated and expensive apparatus now in use, whether of a chemical or mechanical character, thus removing the absolute prohibition which at present exists to the successful working of many mines where after the free gold has been extracted a large amount of concentrates are produced which have to depend upon more expensive methods in order to recover the gold they contain.

The gentlemen who have secured the rights of the patentee for the United States and Canada, and are now introducing the mill for general use, are men of affairs, thoroughly conservative, and in no sense speculators, inventors or promoters, but are among those who estimate from a purely business point of view, the care, time and expense necessary to establish solely upon its merits, a revolutionary process of this kind.

While fully recognizing the general attachment of certificated mining engineers to the use of stamps as a safe and sure means of recovering a considerable percentage of gold from its containing ore, and also recognizing the high intelligence which has developed the various chemical processes now in use for the same purpose, the Gold Extractor Company have avoided all antagonism, or the issuing of advertisements, or florid statements with regard to the mill, or their belief in its power to extract the gold from raw ore or its products, but have patiently and steadily conducted such critical and exhaustive experiments as in their judgment was necessary to determine the merits of the mill as a gold extractor, and its endurance as a machine, before offering it generally to the public for sale.

While recognizing the general attachment of mining engineers to the use of stamps, it is by no means universal, and very grave questions are being raised by men prominent in the profession, on this subject. As an illustration of this, I beg to quote from a paper read before the Institution of Mining and Metallurgy at the museum of Practical Geology, Jermyn St., London, S.W., on Wednesday, December 22nd, by the very eminent engineer, Mr. C. G. Warnford Lock, on Gold Amalgamation. Mr. Lock, in the course of his remarks, says:—

"As to prevailing methods of effecting amalgamation, I venture to put forward the contentions that they are imperfect, that they are wrong in principle, and therefore cannot be perfected. To commence with battery amalgamation, I cannot find a single argument in its favor and I maintain that such amalgamation as does undoubtedly take place when mercury is fed into the mortar, happens in spite of, rather than by reason of the conditions presented, and always at the cost of efficiency in reduction which is the prime and only real duty of the battery. You cannot get two distinct and antagonistic operations out of one machine without detriment to both. This is surely a simple axiom. The effective capacity of the battery is curtailed to a most important extent by the discharge being retarded in order to give time for amalgamation, and by amalgamated plates occupying a portion of the never too abundant space which legitimately belongs to the screens. These evils will be the greater according as the reduction needs to be carried to a finer point so that it becomes greatest in those cases where the reduction process is most prolonged and most costly. Then there is the drawback that the mercury instead of being presented in a clean, substantial, and constant state, is broken up into the most minute particles, many of which must become inoperative, while all are exposed in a maximum degree to the injurious effects of decomposing sulphurets and other sources of contamination from the water. Unless the supply of mercury is much in excess of what the ore requires, amalgamation can only be very partial; if an excess is provided, the waste must be all the greater. During milling operations the amalgamation is quite beyond control, and must proceed hap-hazard. Another drawback which has not been estimated is the evil influence of the metallic iron worn from the shoes and dies. The inconsistency of putting mercury into the battery is obvious. We lament the smallness of the gold particles, and the difficulty attendant on collecting them from the mass of pulp in which they are buried, and forthwith we take pains to smash up the mercury into tiny atoms also, ignoring the fact that in proportion as the globule of mercury becomes smaller its efficacy is diminished, and the risk of its escaping with any gold it may have picked up, is increased. To sum up the case of battery amalgamation, I submit that it must be condemned from both scientific and economic points of view."

The Gold Extractor Co., in furtherance of the general plan, have established and conducted for months, experimental metallurgical works in the city of New York, where they have received large and small quantities of ore from most of all the gold producing States of the United States, Canada and Mexico, and are now conducting experimental work on refractory ores in Virginia, North Carolina, Canada, Montana, and New Mexico, and will speedily have works in operation in Arizona and Oregon.

The information thus gained from these different tests and experiments is fully set forth in the circular now offered for your inspection, which we think establishes the claim that by the use of the Crawford mill, from 80 per cent. to 99 per cent. of the gold contained in the different ores can be extracted and saved in one operation, at less expense both of time and money, than can be accomplished by any other process now in use.

Briefly stated, we believe that one 12 inch Crawford mill, properly erected, supplied automatically with ore reduced to about ¼ mesh, and supplied with clear water, will treat from 8 to 12 tons every 24 hours, and save the average of gold as mentioned above, which the ore contains, at a cost not exceeding $1.50 per ton, and will run continuously with very slight wear and tear.

If five mills are operated, the entire cost of milling, including wear and tear, will not exceed $1.00 per ton.

The per cent. saved, naturally varies with the character of the ore treated, whether the same be hard or soft, and also with the constituent elements of the ore, thus a larger amount of ordinary free milling ore can be treated in a given time than of a sulphureted ore, with a relatively varied per cent. of gold saved. The amount and character of these savings depending upon the speed with which the mill is driven, and the adjustment of the water supply. This, together with the accurate setting of the mill upon a firm and absolutely level foundation, constitutes essentially all the points for which an expert is required. When these points have been carefully considered and adjusted, the mill may be classed as automatic, and will only require the attendance of one person.

It has been found by experiments that the use of hot water in the mill is very advantageous, and that by its use the ore is more perfectly disintegrated, the action of the quick when heated is more pronounced, and hastens the amalgamation of the gold. Different modes for accomplishing this result may be used, varying with the surrounding conditions and the power employed to drive the machinery, whether it be water, steam or electricity. The engineer or superintendent in charge will readily determine the best mode by which the application of heat to the water can be made.

It is also proper to state that five mills, or the product from 50 tons every 24 hours, can be had as cheaply, so far as the cost of operating the mills is concerned, as from one mill, with the exception of the extra power required to drive the greater number of mills.

After the mills are adjusted and the speed and water pressure regulated, one man can properly wait upon five mills. An ordinary travelling derrick or crane, when in place, will open the mills easily and quickly, if from any cause the wearing parts require examination or renewal.

The item of ¼ in. mesh is mentiond as being a suitable reduction of the ore to facilitate the action of the mill, while it may be determined that a still finer reduction may be found useful as experiments progress.

An able engineer, in a late paper says:

"At the outset we come to the question of the state in which gold occurs in nature. On this point there is some diversity of opinion, apparently due to different experimenters working on different ores. But if we admit that in some cases the gold is in chemical combination with tellurium, and perhaps also, with antimony, and that in other cases it may exist as a sulphide soluble in another sulphide, while in a third case it may be present as a chloride, associated with silver chloride, yet the sum of all these cases will give but a very small figure in comparison with the enormous number of instances in which it is only mechanically associated with the other ingredients of the mineral. It is in this predominating case of the gold being in a metallic state that the amalgamation process is applicable."

The Crawford mill is operated upon the belief that gold is not chemically but mechanically combined with other minerals. That being admitted, it may be worth consideration to reduce the ore before it is fed into the mill, to a much finer mesh, and thus increase its power of delivery.

This is essentially a mill for the extraction of gold, and while it does in effect extract a considerable portion of the silver which is often combined with the gold, it does not save all the silver in the amalgam, and when that metal is an important constituent in value of the ore, the residue passes over in the slimes, which may be pan-amalgamated, or treated by different methods that are now under consideration, both mechanical and chemical, either or both of which, it is believed, can be applied effectually and cheaply, and all the silver saved.

Many of the important facts regarding the Crawford mill are discussed in the circular now before you, hence I do not propose to weary you with a repetition, but refer you to the fact that results of primary importance have been obtained by the treatment of Canadian ores with the Crawford mill, under the observation of gentlemen well known to be close critics of the highest character. It is possible that some of these gentlemen may be present, and if so, I shall cheerfully appeal to them for a confirmation of my conclusions as to its merits.

The Crawford mill has now been sufficiently tested and examined to warrant its presentation to all parties interested in mining gold ores. It will soon be in operation in the gold producing States of the Union, Canada, Mexico and Central America and probably will work a change in the amount of gold produced, as well as the value of the mines from which it is obtained.

It will not only, as we believe, make mines remunerative which are now abandoned, but it will provide the means for the profitable recovery of gold contained in the large deposits of tailings which have accumulated and in many instances remain, as a bequest from the use of the stamps, ordinary mills or chlorination.

Some facts relating to this latter process may be interesting, and while not offered for the purpose of depreciation or antagonism to a well known and much esteemed process for the recovery of gold, are presented from the official reports of the United States census recently published, in which the question of chlorination is ably discussed, and therefore may be worth consideration.

In that report the writer goes on to say in the chapter on California, page 144, and speaking of the general use of chlorination in that State to obtain the gold from concentrates :

"A chlorination plant with a capacity of six tons in 24 hours, costs from $6,000 to $7,000, and it will cost such a plant about $10 a ton to treat the concentrates. From 90 per cent. to 92 per cent. of the gold value of the concentrates is recovered. At all important mining points in California there are now custom chlorination works, which charge about $20 per ton for treatment, and guarantee about the above percentage of returns."

In the *Engineering and Mining Journal* of August 10th, 1889, quoted in the Census Report, page 143, appears the following :

"The chief objection to a plant of 50 tons or more capacity in 24 hours for the Plattner process, is the enormous size, and the length of time it requires to complete a single operation. The limit to the size would probably be a 50 ton capacity ; when more is treated, another battery of tanks would be necessary."

Assuming these conclusions to be correct as to the cost of chlorination by the Plattner process, and that the article from the *Journal* is correct as to capacity, it may be useful to contrast the cost and results of treating the same amount of ore or concentrates by the Crawford mill ; thus Plattner's process to treat 50 tons of ore every 24 hours, will require an expenditure for plant of $50,000, which can be treated at the mill at a cost of $10 per ton, equalling $500, and saving from 90 per cent. to 92 per cent. of gold.

Five 12 inch Crawford mills can be put in place, if the approach is at all reasonable, for the sum of $15,000, and will save the gold at a cost not exceeding $1.00 per ton, thus showing in favor of the Crawford mill $35,000 in cost of plant, and a saving in treatment of $450 on every 50 tons of ore treated.

It may be that the cost of a chlorination plant to handle 50 tons of ore daily, would be less in proportion than the same plant to handle six tons. Of this I can have no accurate means of judging, but as a general rule the cost of constructing any elaborate plant will exceed the estimate. But in regard to the Crawford mill there can be no mistake, if the place where it is to be located is in California and within thirty miles of a railroad station.

This contrast is made with the Plattner process for the reason that it is the favored and recognized process used in California, where the largest amount of gold now produced is subjected to the chlorination process. The cyanide or other process may be equally or more valuable but I submit that in the main the same results would obtain.

In regard to the amount of gold which is obtained by the Plattner process, recently there has been occasion to treat a small amount of slimes sent to the metallurgical works in New York from a large chlorination establishment in Nevada, and the Crawford mill was still able to recover from one sample gold to the value of $8.27 per ton, and from the other $6.20, which had not been saved by the chlorination.

The quicksilver bath can be renewed at any time when necessary without opening the mill or disturbing its operations, except for a very brief period.

The position which this bath of mercury occupies, and its method of operating upon the gold, constitutes an important factor in the economy of the mill. It is an essential element that pure water only should be brought in contact with the mercury. The mercury is not in any way ground up with the material, or brought in contact with deleterious elements which the ore may contain that would be calculated to sicken the mercury. It thus exercises its full power for amalgamation, and can be recovered with barely a trace of loss.

In discussing the question which the bath of mercury occupies, in the paper referred to, Mr. Lock remarks:

"It may appear to be necessary to lay stress upon the urgency of starting with clear and pure mercury, yet that is a point often overlooked. Moreover, on exposure to the air, the surface of the mercury will become oxidised sufficiently to hinder actual contact with the gold. Another important consideration which is apt to be lost sight of, is the value of having a good body and large surface of mercury.

"When mercury is broken up into a number of tiny atoms, the oxidation of the multiplied surfaces must be enormously hastened, and the efficiency thereby reduced. When the particles become very fine, they are rendered actually valueless as amalgamators, and finally disappear in the tailings, especially in the presence of even small proportions of sulphide undergoing decomposition. Amalgamation is essentially a wet operation, and cannot be satisfactorily accomplished except in the presence of water. Hence it is of importance to secure water which is free from salts in solution and solids in suspension. Mine waters are especially bad on this account. In a low temperature, amalgamation is sluggish, and, therefore, it is customary to supply heat in cold weather; but summer water is often much less pure than winter water, and decomposition of the sulphurets is more rapid in the presence of heat, so that these two conditions may combine to more than counteract the advantages of a genial climate."

The question of durability, or wear and tear, is very important, and has commanded the close attention and scrutiny of the engineers who have had this matter in charge, and while crucial experiments have not so far extended beyond four months, still we feel justified in saying that the wearing parts of the mill will not depreciate or require renewal as often, or to such an extent, as the same renewal or repair is required in any other existing process for the recovery of gold.

Only the best material is used for the wearing parts, and experiments which are now being conducted with chrome steel, have so far shown no perceptible wear and tear. Every effort has been made, and will continue to be made, to definitely settle this very important point, and we fully believe that the wear and tear, so far as the grinding parts are concerned, has been reduced to a minimum.

ANNUAL GENERAL MEETING.

WINDSOR HOTEL, MONTREAL.

FRIDAY, 24TH FEBRUARY, 1893.

The proceedings of the Annual General Meeting, adjourned on Wednesday, 22nd February, were continued in the new Club Room, Windsor Hotel, Montreal, on Friday, 24th February. There was a large attendance of members. Hon. George Irvine, Q.C., presided.

THE DUTY ON MINING MACHINERY.

MR. B. T. A. BELL—One of the resolutions left over from the united meeting yesterday was that relating to the Customs tariff on mining machinery. As you know the Dominion Government with the object of encouraging the development of our mines amended the tariff in 1890 so as to admit all machinery for mining purposes of a class or kind not manufactured in the Dominion free of duty. The period was for three years and expires, I think, next month. The Government has, however, again renewed this provision until May, 1896. The Act is in the main liberal, but difficulty seems to have been experienced in its interpretation by the collectors at some of the ports of entry. While in several districts no difficulty has been experienced in passing mining machinery in free of duty, at others the duty has been enforced on machinery which distinctly was not made in Canada. The collectors seemingly were not instructed what class and kind of machinery should come in duty free. It has been thought that some representations might be made to the Government on the subject.

CAPT. R. C. ADAMS—This is one of the questions I desired to speak about. As it is the law is a perfect farce. I enquired, when in British Columbia, how it worked there and found that it created a great deal of bother. An importer brought in some piece of machinery which the collector often held for duty pending investigation, and then as likely as not some country blacksmith was found to claim that he could manufacture the machinery. I would like to see this Association, now that tariff reform seems to be in order, make some expression of opinion on the subject and not be content that the paltry concessions given us be continued.

MR. J. BURLEY SMITH—The mining industry is quite as important, if not more so, than any of our other industries, and it seems to me an unwise policy to hamper its development by any tariff restrictions. At present we are only partially relieved of the duty. I refer to the stipulation in this Act whereby only machinery that is *not* manufactured in Canada shall be admitted duty free. It opens a question as to what machinery is free. For instance while rock drills as *a class* are manufactured in Canada, only two particular *kinds* are made—the Rand and Ingersoll. Yet in Europe at the present moment there are actually 34 distinct types of rock drilling machines, some of which contain improvements which were not even dreamt of at the time the Rand and Ingersoll-Sergeant were patented. Now does the law permit me to import any of those other *kinds* of drills duty free?

MR. B. T. A. BELL—Certainly; I do not think there can be any doubt about it. The Government provides you with a form of declaration in which you simply swear that the machine you are importing is of a class and kind not manufactured in this country, and the collector is bound to pass it. The law is good enough of itself; it is its operation at some of the ports of entry that is defective.

MR. S. P. FRANCHOT—According to the Canadian Patent Act it is necessary that the machinery—in order that the patent may be perfected—shall be manufactured within two years from the date of the patent. I am in favor of a deputation waiting upon the Comptroller of Customs, and asking that the collectors be specifically instructed what machinery is entitled to free entry, and that the most liberal construction be placed by the collectors in their interpretation of the law.

MR. J. BURLEY SMITH—Do you not think that the fact of the importance of the extension and development of the mineral industries, we might with reasonable assurance ask the Government to take of the duty *in toto?*

CAPT. ADAMS—Hear! Hear!

Mr. B. T. A. Bell—The Government is perfectly liberal, but it must be expected to give reasonable protection to our own manufacturers.

Mr. W. H. Irwin—Mr. Bell's conclusion is that the Act is liberal. The experience of my company has been different. The meaning of the Act is vague and ambiguous—it is so loosely worded that almost any thing we use in asbestos mining can be construed by the collector to be either directly or indirectly manufactured in Canada. Can Mr. Bell tell me just what machinery can be brought in free under this Act?

Mr. B. T. A. Bell—That would be a big contract. The whole essence of the Act lies in the words "class or kind." For instance rock breakers as a *class* are made in Canada, but the types known as the 'Forster,' 'Wiswell,' 'Cyclone' and numerous other *kinds* of crushers are not manufactured, and we are entitled beyond a peradventure to bring in these free. The same applies to pumps, and all the various *kinds* of specialties not manufactured here. The Department evidently is not posted on the details of the subject.

Mr. E. B. Haycock—I have brought in a gold mill and other machinery and have never found any difficulty in getting entry duty free. I asked the Department if I could import a Cameron pump free and received a favorable answer.

Capt. Adams—I wish to move that it is the opinion of this Association that the Dominion Government should remove all duties upon mining machinery.

Mr. J. Burley Smith—I have great pleasure in seconding Capt. Adams' motion.

Mr. John E. Hardman, (Halifax), said he had had considerable experience in the operations of the Act, particularly with reference to the importation of machinery for gold mining. At first they had found some difficulty in getting the collector to arrive at a proper interpretation of the meaning of the Act. As an example, copper plates were admitted free of duty, but when silvered for amalgamating purposes the Government, in order to protect a few silver plating works—who as a matter of fact had no bath large enough to take in these plates—charged the duty. Representations were made by the Gold Miner's Association with a result that a clearer understanding now existed in Halifax, and there was comparatively little difficulty now in getting free entry for machinery. In every case where the form of Declaration had been filled in the importer had never failed to get his machinery in free of duty.

Mr. W. H. Irwin—Unfortunately our experienee at the port of Sherbrooke has been very different.

Mr. Hardman—In Nova Scotia we have no fault to find with the Act.

Mr. W. H. Irwin—While I quite sympathise with Capt. Adams' motion, I do not think any practical results can be obtained by passing it. I would move that a deputation from the Association be appointed to confer with the Comptroller of Customs at Ottawa, with the object of obtaining, if possible, a definition of what machinery can be imported free under the Act.

Mr. L. A. Klein—I know of many instances where the duty on mining machinery has been collected in Quebec. I see no practical benefits the Act confers on our province.

Mr. R. T. Hopper—Mr. Klein corroborates my experience.

Mr. Irwin's motion was then put to the meeting and was carried unanimously.

The following were appointed to wait on the Comptroller:

Hector McRae (Electric Mining Co.), Ottawa: W. A. Allan (Little Rapids Mine), Ottawa; S. P. Franchot (Emerald Mining Co.), Ottawa; E. B. Haycock, (Star Gold Mines), Ottawa; R. T. Hopper (Anglo-Canadian Asbestos Co.), Montreal; J. Burley Smith (British Phosphate Co.), Glen Almond; and B. T. A. Bell, editor *Canadian Mining Review*, Ottawa.

THE LICENSE ON POWDER MAGAZINES.

Mr. S. P. Franchot asked what had been the outcome of the representations made by the Association respecting the repeal on the tax on powder magazines at mines.

Hon. Geo. Irvine, Q.C.—A deputation waited on the Hon. J. S. Hall, Provincial Treasurer, at Quebec. We were received very favorably and he promised to give us a reply later on. He wrote the other day as follows:

QUEBEC, 4th February, 1893.

HON. GEORGE IRVINE,

President Mining Association, Quebec.

DEAR SIR,—When the deputation of the Mining Association met me the other day, I promised an immediate answer. I saw a great deal of justice in the demand of the Association and delayed answering hoping to be able to give some relief this session, but, after carefully considering the matter, I don't see how I can open the question, but in the re-adjustment that will take place for next session, I have no doubt I will be able to accede, in part, to your request. I hope, therefore, you will see that the members of the Association pay what is due.

Yours truly,

JOHN S. HALL.

AMENDMENTS TO CONSTITUTION.

MR. S. P. FRANCHOT—Moved that Section 10 of the Constitution and By-laws entitled "Duties of Officers" be amended by adding the following words :—

"A President shall be elected at the Annual General Meeting by ballot, and shall not be eligible for re-election to a third consecutive term of office."

MR. BELL—We cannot consider amendments of this nature without notice of motion. Such a course would be irregular and would establish a dangerous precedent.

MR. FRANCHOT—This is our adjourned annual meeting. We have a full attendance.

HON. GEORGE IRVINE—I think Mr. Franchot's idea common sense enough; but I do not think there is any common sense in making alterations to the Constitution without notice.

MR. FRANCHOT—I think I am within my rights in asking for a vote.

MR. BELL—At the Annual Meeting on Wednesday I asked if it was the wish to read over the Constitution, with a view to the consideration of any amendments. It is too late now, without notice of motion and a special meeting called for the purpose.

MR. A. W. STEVENSON moved the appointment of a committee to revise the Constitution and By-laws and submit any such to the next Quarterly General Meeting.

Mr. Bell—Seconded.

Mr. L. A. Klein—According to Constitution the Association should hold four meetings in the year, but the meetings had been held at the sweet will of the Secretary.

Mr. Bell—The meetings have been called by Council. No fewer than eight had been held during the past year. The September meeting had, however, been dropped. There was no use in calling the members together unless they had something to discuss.

Mr. Franchot's proposed amendment was put to the meeting and carried.

Mr. W. H. Irwin suggested that all the past presidents of the Association should be appointed honorary presidents.

THE SECRETARY'S RESIGNATION.

Mr. Bell reminded the Association that at the meeting on Wednesday he had tendered his resignation and that the office was therefore vacant. He regretted that the increased work incidental to the Association's operations seriously interfered with his business and compelled him to ask for the election of one better able to attend to their interests.

Capt. Adams—I regret that Mr. Bell has taken this attitude. He has not only been the organizer of this Association, but a second Warwick—a king maker; appointing his presidents and his officers. I cannot see how we are going to run without him—except it be into the ground, where all miners, like other men, go.

Mr. A. M. Evans—Personally, I shall be very much opposed to his resigning or being forced to resign.

Mr. S. P. Franchot—Mr. Bell has frankly stated that the onus of the position under existing circumstances is too much for him. As his personal friend I would move that his resignation be accepted. There are other members who should take some of the responsibility and work.

Mr. W. H. Irwin—Will Mr. Bell reconsider his decision?

Hon. George Irvine, Q.C.—I was absent from the room when this question came up. I am satisfied Mr. Bell's services cannot be dispensed with. Of course if he has made up his mind we can say nothing; but all I can say is that Mr. Bell's retirement will mean calamity to the Association.

CAPT. ADAMS—I move in amendment to Mr. Franchot's motion that the matter be left over until the next meeting.

MR. R. T. HOPPER seconded.

MR. S. P. FRANCHOT having withdrawn his motion, and Mr. Bell having consented, Capt. Adams' resolution was adopted.

NEW MEMBERS.

On motion of Mr John J. Penhale, the following were elected members:—

T. B. Bakeman, S. W. Jenckes.

A NATIONAL MUSEUM WANTED.

MR. BELL—On the list of resolutions unfortunately crowded out of the business at the united convention last evening was one which deserved the attention of this Association. He referred to the urgent necessity for enlarged and safer housing of the magnificent national collection gathered by the staff of the Geological and Natural History Survey of Canada. The building was antiquated and wholly inadequate to the wants and uses of such an important branch of the public service. Being contiguous to a tenement of stores it was in danger of being destroyed by fire at any moment. The floors were shaky and threatened to cave in. A large portion of the collection, for lack of accommodation was crowded into the open yard where valuable specimens lay exposed to the inclemency of the weather. The time was opportune to press upon the Dominion Government the urgent necessities of the case. The building contained the most precious collection of minerals, fossils, botanical and antiquarian specimens contained under one roof on the North American continent. The loss of such a valuable collection would be irreparable. The Government had spent hundreds of thousands of dollars in exhibiting the resources of the Dominion in Great Britain and Europe, and extensive preparations were being made for a costly exhibition in Chicago. In Ottawa the Government to-day could not show properly the wealth of our country even to the members of its House of Commons, many of whom were as ignorant of our great national resources as the veriest stranger who comes within our gates. He moved that the deputation appointed to interview the Comptroller of Customs, should, on the same day, seek an interview with the Hon. the Minister of the Interior, and urge upon him the necessity of enlarged and safer housing of these great national treasures.

MR. W. A. ALLAN briefly seconded and the resolution carried unanimously.

A SUGGESTION FOR THE GEOLOGICAL SURVEY.

CAPT. R. C. ADAMS moved that the Association, through the Secretary, express to the Director of the Geological Survey its desire that the valuable photographs exhibited by Dr. Ells, during the discussion of his paper on the "Apatite deposits of the Province of Quebec," before the United Convention, be reproduced in colors and issued as part of the Survey Reports.

MR. W. A. ALLAN suggested that the matter might suitably be brought to the notice of the Minister of Interior at the time of the interview anent the survey building.

VOTES OF THANKS FOR COURTESIES EXTENDED DURING THE CONVENTION.

MR. W. H. IRWIN moved that the hearty thanks of the Association be tendered to the following for courtesies extended to the Association and its guests:

Directors of the Victoria Skating Club.
President of the Montreal Amateur Athletic Association.
President of the St. George's Snowshoe Club.
President of the Thistle Curling Club.
President of the Montreal Snowshoe Club.
Governors of McGill University.
President Canadian Society of Civil Engineers.
Canada Iron Furnace Company, Montreal.
Col. A. A. Stevenson, Montreal.
Sir Donald and Lady Smith, Montreal.
T. G. Shaughnessy, Canadian Pacific Railway, Montreal.
The Dominion and Quebec Governments.

The meeting then adjourned.

EXCURSION.

RADNOR FORGES AND GRANDES PILES, QUE.

SATURDAY, 25TH FEBRUARY, 1893.

On Saturday, 25th February, the proceedings of the International Mining Convention were brought to a close by an excursion to the works of the Canada Iron Furnace Company (Limited) at Radnor Forges and Grande Piles, Que. About two hundred ladies and gentlemen took part in the proceedings, leaving Montreal at 8 a.m. by special train, courteously granted free of charge by the Canadian Pacific Railway Company. The weather was of the most delightful description. Luncheon was served on the cars at 11 o'clock, and between 12 and 1 o'clock Radnor Forges was reached. The party here left the train and paid a visit to the works of the company (fully described elsewhere in this volume), after which an adjournment was made to the Episcopalian church, where Capt. Robt. C. Adams, Montreal, Vice-President of the Association, took the chair.

THE CHAIRMAN, after mentioning the fact that the gathering had only a very limited time to spend in the church and listen to the gentlemen who were to speak, said : "We are met in this church to do honor to an industry which has existed for many years, and which has come to a joyous condition of being ; and we believe that under the able and continued management of the gentlemen of whom it has been our very good fortune to be the guests to-day, there is a very great future before this industry. We can but regard these gentlemen as philanthropists, who, by the medium of such an industry, provide a means of livelihood to many people, and help to sustain and elevate the vigor and industrial greatness of a country. I say it is right that a celebration should be held in a church in honor of an industry which is so closely united with the sentiments and practices of philanthropy. I observed in the admirable souvenir which these gentlemen have prepared for us that this delightful and romantic region is also likely to prove one of advantage to the treasure hunter; and I now understand why we had such an easy journey down here this morning, because I am reminded of an old saying: *facilis decensus Averno.* But now that we have taken refuge in a church we shall escape any advances which his Satanic majesty might be pleased to make.

I have received letters of regret from the following distinguished gentlemen, who were to have been with us to-day, but who for one reason or another have been prevented from doing themselves and us the honor of attending: Consul-General Knapp; The Lieutenant-Governor of Quebec; The Hon. Mr. Flynn; The Hon. Mr. Louis Beaubien; The Hon. A. R. Angers; The Hon. Mr. Mackenzie Bowell; The Hon. Mr. Tupper; The Hon. Mr. Costigan; The Hon. Mr. Paterson; The Hon. Mr. Ives; The Hon. Mr. Haggart; The Hon. Mr. Ouimet; The Hon. Mr. Smith; The Hon. Mr. Laurier; Sir A. P. Caron; Sir Joseph Hickson and Mr. L. J. Sergeant, of the Grand Trunk Railway.

I have now much pleasure in calling upon Dr. Howe to address you.

Dr. Howe (Boston)—Mr. Chairman, ladies and gentlemen: I firmly believe that an idle man's brain is the devil's workshop. How often has been deplored through Northern New England and Canada the lack of suitable employment for the farmer and his household during the months of winter, when the necessities of the farm do not call for the exercise of much labor. The greatest benefactor to Northern New England would be the man who would bring to the farmer an industry which would occupy the members of his household during the spare and idle time of the year. A long and important step in this direction has been taken by our hospitable young hosts of to-day in teaching the farmer how to mine bog ore, which everywhere in this district surrounds him, and in furnishing him a steady and valuable market, enabling him to use his spare time to advantage, and to utilize a waste product; transforming a noxious article into a priceless one. For this they deserve the thanks, sympathy and support of the whole community, and for their kindness and unbounded hospitality we all thank them cordially, and wish them God-speed in their good work.

Dr. R. W. Raymond (New York)—Mr. Chairman, ladies and gentlemen: Agriculture and mining are, I would say, two great industries, neither of which can get along alone. We have found out one side of this truth in the United States, where the mining engineer and the mining pioneer have attempted almost in vain, and with unfortunate sacrifices, to put that industry into operation in countries where it was not supported by any other, and where the business of mining had to carry upon its back the load of all the necessities in the life of man.

Here we have an illustration of the opposite side of the same truth, where mining comes to the rescue of agriculture; as our President has expressed it, by utilizing those forces and also by putting into the very neighborhood of the man who brings forth the products of agriculture, and the man who wishes to use those forces, the wealth of the mines; and into the hands of each the power to benefit by them. Thus bringing the producer and the market close together. The progress of science has continually necessitated that one thing should be superseded by another; and yet this is by no means true in a strict sense. If you will allow me the metaphor in this edifice, you will remember how in the history of the Jews the various tribes, the Ammonities, etc., were absolutely annhilated, according to the records of the Testament, in the first chapter; and yet you find them turning up all right in the second chapter. And so we have in many cases of a so-called superseded industry, a survival and revival that is remarkable. We call charcoal iron a deceased business. We say it is played out. But all the while there is more charcoal iron made and more wanted than ever. And while charcoal iron has the properties of charcoal iron, and while the universe retains the laws of the universe, naturally charcoal iron will remain in demand.

I cannot help feeling the great fitness of this scene and this moment, as we are gathered here from different countries and surrounded by the flags we love; and as we look out through the windows upon these two great productive industries, seeing around us an evidence of the union of the Church and School—a guarantee, I trust, that learning will here be prosecuted in the fear and love of God, and theology promulgated with some respect for sound reason and education—I say, viewing and feeling this, I cannot help being conscious of how auspicious is the scene upon which the bright skies of to-day bend! I feel, and with a deep sense of gratitude—sometimes so deeply that I cannot put it into words—the privilege and the joy and the glory of having been born at this time and upon this continent! I feel, as I said to the young men of McGill University yesterday, that we have been crowned with the greatest gift ever given to man—the gift of being able to stand by and see an empire grow ; to tend its infancy, to join hands with its youth, and to rejoice in the strength of its freedom ! And that is your privilege and mine. There never will be, there never can be, anything more glorious than these pioneer beginnings of the greatness of the new age which you and I are privileged to look upon.

MR. A. BLUE (Toronto)—This is not the first time I have had the pleasure of visiting Radnor Forges. A few months ago it was my privilege to spend a few days here and see the work that was being carried on by the gentlemen who are our hosts to-day. I was then very greatly impressed with the good work they were doing for the community and for the province. I was desirous of knowing what they were doing here, so that we in Ontario might be assisted by trying to do likewise, where we know the value of the iron industry by the want of it. We have been going to school somewhat to our neighbors. We have been attending the meetings of this great Institute which has met this year in Montreal, and have been getting inspiration and encouragement from them. I hope the time is not far distant when we will be able to follow in their footsteps, however much behind them we may be. They began the mining and manufacture of iron very early in the settlement of their country. They encouraged the industry then, and continue to encourage it ; and it is to-day, I think I may say, the greatest, next to agriculture, which that country possesses. Here in the Province of Quebec, as well as the Province of Ontario, we find our young men leaving us for want of employment at home. We find them fleeing from their own land. I feel very keenly the situation, and I think a great effort ought to be made to find new fields of employment for our own people, by establishing in various parts of our country, industries such as that here, so that employment may be given ; and I trust that the Dominion Government, and the government of each province, will do their utmost to cultivate such industries.

MR. JAS. CRATHERN (of Messrs. Crathern & Caverhill, Montreal), said :—Mr. Chairman, ladies and gentleman : I observe on reference to the souvenir prepared by Mr. Drummond, that the late Hon. Senator Ferrier worked the property of the Forges over 40 years ago. At that time I was a clerk in his employ, and my duty was partly to superintend the sale of the goods manufactured, which were principally at that time double stoves, coolers—which were often used for sugar purposes—bar iron, etc. The stoves were used entirely throughout the Province of Quebec, and I may say were very efficient articles. That was so long ago, however, that it would be out of place for me to ask any of the ladies present if they remembered any of those stoves. If I remember correctly, the first discovery of the value of the ore was made by a company in Troy, actively engaged in the manufacture of railway car wheels. They discovered that the ore made the very best railway wheels, and I believe the gentlemen who are now working this industry are largely engaged in producing the same wheels. I am sure they are to be congratulated very much upon the progress they are making and apparently have made already; and I trust that with the continued aid of the National Policy they may be eminently successful.

The speeches and subsequent applause having terminated, the party sought the train again; and after a pleasant run of fifteen miles, reached Grandes Piles, situated upon the great and beautiful St. Maurice river.

Here a dozen or more improvised sleighs were in readiness, and the party were treated to a delightful drive through the pine forest from which the Company derives its fuel for charcoal. An excellent supper was served on the train, and Montreal was reached shortly after nine o'clock. In the evening a large company was received by Sir Donald and Lady Smith, at their residence on Dorchester street.

THE DUTY ON MINING MACHINERY.

INTERVIEW WITH THE HON. N. CLARKE WALLACE.

OTTAWA, 9TH MARCH, 1893.

Pursuant to resolution of 23rd February, a deputation from the Association had the honour of an interview with the Hon. N. Clarke Wallace, M.P., H. M. Comptroller of Customs, at Ottawa, respecting the law relating to the free entry of mining machinery. Mr. T. J. Watters, Assistant Commissioner of Customs was also present. The deputation included the following members:—

Mr. S. P. Franchot, Buckingham.
Mr. J. Burley Smith, Glen Almond.
Mr. Hector McRae, Ottawa.
Mr. W. A. Allan, Ottawa.
Mr. B. T. A. Bell, *Secretary.*

The deputation having been introduced, Mr. S. P. Franchot, said: We have come to see you, sir, as representatives of the General Mining Association of the Province of Quebec, regarding the present law relating to the importation of mining machinery. As you are aware, the Act admits free of duty, all mining machinery of a class or kind not manufactured in the Dominion. The law in itself is at present perfectly satisfactory, but its interpretation by some of the collectors has not been satisfactory.

For instance, I am acquainted with the case of a mining man in this district, who had purchased a diamond prospecting drill in the United States, which, under the Act, was entitled to free entry, but the collector had ruled that because certain sections of its equipment were made in the country, duty had to be paid on these portions of the drill. Difficulty was experienced in getting the collectors to properly understand the meaning conveyed by the language in the Act, "class or kind." For example, the Forster Rock Breaker was a distinct type or kind of a class of crushing machinery, not manufactured here, and although the "Blake," another kind of the same class of machine was manufactured in Canada, it would be entitled to free entry. Instances had come to his knowledge where the collector had ruled that because the "Blake" was made in Montreal, all other rock breakers were dutiable, which was erroneous.

Hon. Mr. Wallace—That is to say, mining machinery may be of the same class but of a different kind. Where do most of the importations come in?

Mr. Franchot—At Ottawa, Sherbrooke and other centres near mining points. Several importations under the Act have come under our personal knowledge, some have been allowed free entry, others had to pay duty. The language of the Act being so clear, and also so comprehensive, there should, one would suppose, be no difficulty in its administration. In Nova Scotia there are frequent importations of silvered copper plates which are a part and parcel of the amalgamating machinery of every modern gold mill. These plates are used to catch the fine gold coming from the stamps, and are made of soft rolled copper, subsequently annealed and coated, or plated with a thin layer of metallic silver on one side. They are not used in any other business, or for any other purpose. Entry under the Act was sought in one instance to our knowledge, and by the local collector was referred to your Department, where the ruling was made by the then Commissioner of Customs, that such plates "were not mining machinery such as was contemplated by the Act." There are no copper works in the Dominion which do or can make the plain copper plates and anneal them. Further, there is not an electro-plating establishment in the Dominion which has a bath large enough to take in and properly plate these coppers with silver; hence, even were the coppers available, the manufactured amalgamating plates could not be produced, at present by any concern in Canada. It is, therefore, evident that these plates are of a "class or kind," which not only is not, but which cannot be made here. Now we would respectfully suggest that definite instructions be given to the collectors, advising them of what machinery is really made, and is chargeable to duty, and if it meets with your approval, we would be pleased to aid you in the preparation of such a statement.

Hon. Mr. Wallace—We have such a list as you mention already. Here is a copy which is a memorandum of the mining machinery made and kept for sale by the Jenckes Machine Company at Sherbrooke, Quebec:—

"File No. 4939-91. No. 520 B.

MEMORANDUM.

CUSTOMS DEPARTMENT,
OTTAWA, 3rd December, 1891

Collector of Customs,
Port of..

MINING MACHINERY.

Referring to Memo. No. 427 B., of the 28th November, 1890, I am instructed by the Honourable the Minister of Customs, to inform you that this Department has received authentic information that the following machines and apparatus are made and kept for sale by the Jenckes Machine Company of Sherbrooke, Quebec, viz:—

Hoisting and Winding Engines of all sizes.
Stone and Ore Crushers of all sizes.
Cornish and Mine Pumps of all sizes.
Steam Boilers of all sizes.
Cornish Rolls and Revolving Screens of all sizes.
Stamp Batteries and Mortars.
Wet and Dry Pulverizers for silver and gold ores.
Griffin Mills for Wet and Dry Grinding.
Herreshoff Patent Water Jacket Smelters and equipment.
Plain Water Jacket Smelters.
Pressure Blowers and Smelter Outfits.
Reverberatory Furnaces.
Buckner Revolving Furnaces.
Convertors, Bessemer and other types.
Jigs and Buddles.
Harrison's Patent Percussion Coal Cutters.
Rand Percussion Rock Drills.
Rand Steam Air Compressors of all types and sizes.
Halsey's Pneumatic Pumping Plant.
Diamond Rock Boring Machines.
Concentrating Machinery, for iron and other minerals.

J. JOHNSON,
Commissioner of Customs."

MR. W. A. ALLAN—All those who are engaged in mining are perfectly familiar with what is made in Canada; and the mining men do not ask the Government to allow any machinery in here which *is* made in Canada. They do, however, claim that there appears to be so much difference existing between the interpretation of the Act by certain of the collectors that they would like the matter to be made clear. At the meeting of our Association in Montreal, a few days ago, Mr. John Hardman of Oldham, Nova Scotia, one of the most eminent of our mining engineers, and who is largely engaged in mining, expressed himself as being very much astonished to hear of our mining men in Quebec having had to pay duty. Mr. Hardman said that recently there had been no difficulty in getting in machinery under the provisions of the Act. But other gentlemen in Quebec expressed much dissatisfaction.

MR. B. T. A. BELL—I think the statement shown us by Mr. Wallace may have had a good deal to do with confusing the collectors. While generally speaking it may be taken as a fair statement of what the Jenckes Company manufactures in mining machinery, it is very vague and indefinite in its specifications and adapted by the department as a reference would tend to confusion in the mind of the collector not acquainted with mining. For instance it says "Stone and ore crushers of all sizes." All mining men know that there are various *kinds* of stone and ore crushers. The Jenckes Company I believe make the Blake-Marsden pattern, but there are others such as the Foster, Gates, Wiswell, Cyclone, and many others distinctly different types of rock breakers adapted to various requirements in mining work which are not made by them or any body else in Canada, and which we are distinctly entitled to bring in free.

HON. MR. WALLACE—Why should you be entitled to bring them in free? They are of the same kind.

MR. BELL—No sir; of the same class but not of the same kind. They are separate patents suited to different kinds of work.

HON. MR. WALLACE—If any machine is of the same *class*, the Act says it shall not come in free.

MR. BELL—The Act says distinctly "class or *kind.*" It was, as you will remember, introduced by Mr. Mara the member for Victoria, B.C., and was intended to be a broad measure calculated to stimulate the development of the mineral resources of the country, and more particularly those mining districts of British Columbia, which were far removed from any Canadian Manufacturing centre, and whose natural market was the United States. As the Act stands, and if properly interpreted, it is a wise measure. But collectors at ports of entry seem to require some statement which will guide them as to the machinery which is actually on the market for the miner in Canada. I might mention another hardship that has been brought to my notice, the case of Mr. J. F. Stairs, M.P., whose company, the New Glasgow Iron, Coal & Railway Co., has had to pay duty on a coal-washing plant. There is no house in Canada manufacturing coal-washing plants, and it should have come in free.

HON. MR. WALLACE—Has Mr. Stairs appealed from the decision of the collector?

MR. BELL—I understand he was informed that the plant in question was not *mining* machinery in the strictest sense of the word. But while this may be true the plant was just as essential to the proper and economic working of a coal mine as the engine which hoists or the pump which keeps the mine free of water. It should have come in free.

MR. J. BURLEY SMITH—If such an interpretation is made the miner would be prevented from getting the benefit of the most modern kind of machinery.

HON. MR. WALLACE—You are not prevented. You can import any machinery you like to pay the duty on.

MR HECTOR MCRAE—It is pretty nearly the same thing.

MR. J. BURLEY SMITH—There are, for instance, only two types of rock drills made: The Ingersoll-Sergeant and the Rand. In England there are 34 different drills made. The latest drill, the "Saw," which took the gold medal at the recent Exhibition of Mining and Metallurgy in London, and which was acknowledged by experts to be the best in the world, could not if the meaning were restricted to the word *class* be admitted into Canada *free* because rock drills as a *class* are manufactured in Canada.

MR. HECTOR MCRAE—The Alberta Railway and Coal Co., at Lethbridge, bought a Diamond rock boring machine, which is a large machine on wheels, with boiler, pump and engines attached. It cost from $6,000 to $8,000. They were told that they had to pay duty on the power part, the boiler, engine and carriage. The Customs authorities made them furnish a detailed statement of all the different parts invoiced, and the collector claimed duty on everything except the actual drill. Yet Diamond drills are distinctly exempted from duty according to the Act.

HON. MR. WALLACE—Are the engine and boiler the most expensive portions of the drill?

MR. HECTOR MCRAE—Yes, the most expensive. I fyled the oath of declaration, but the collector refused to pass the drill and said we would have to pay $850 duty. We went to see Mr. Johnson, and he said the part exempt from duty was the "crown head" in which the diamonds are set. Afterwards he allowed us to pass the outfit by paying duty on the hose, pump, diamond setting and tools.

HON. MR. WALLACE—The man who manufactures in Canada finds, if he is a man of enterprise, that it is in his interest to get up the latest and improved machinery.

MR. ALLAN—The question is, if we cannot get this improved machinery here, are we or are we not to get it free of duty from other countries?

MR. MCRAE—The consumption of specialties in mining machinery is comparatively small, and it would not pay to manufacture them in Canada.

MR. B. T. A. BELL—Your collector is ordinarily intelligent enough, but he knows nothing about mining machinery, and he would be very apt to make mistakes to the detriment of the miner if he is to use this list of the Jenckes Machine Co. as a guide.

HON. MR. WALLACE—I quite realize the difficulty, as the collector at any port is not an expert in mining machinery. He has to be guided by this list. It is not a cast-iron statement, but simply informs him that the department has received authentic information that such and such machinery is made and kept for sale at Sherbrooke by the Jenckes Company.

MR. S. P. FRANCHOT--They are not kept for sale. I will warrant you cannot get one-tenth of what is on that list. You give them an order and have to wait a year for it to be filled. If I take up on short option a tract of mineral country and want to immediately prospect it I can wire to Chicago and to-morrow a Diamond drill will be on the way to Canada. But if I apply to the Jenckes Company, ten chances to one

I cannot get the drill before my bond expires. But I cannot afford to pay $800 duty on a machine. What option have I?

Mr. McRae—I wrote the Jenckes Company asking them what they would charge for a No. III. prospecting drill, and they replied $2,300. The same outfit is sold in New York for $1,500. The difference would be $800 duty.

Hon. Mr. Wallace—Have you specific cases of grievances of any consequence that you would lay before us and say: "There is a sample of the injustice being done to the mining industry."

Mr. Bell—We have already cited instances, but we can give you others.

Hon. Mr. Wallace—Well then, what we will do is this: We will have a uniform decision; that is the importers will be placed on a uniform footing with specific instructions.

Mr. Bell—Would you accept a statement prepared by our Association of the various classes and kinds of mining machinery known to be made in Canada at date?

Hon. Mr. Wallace—We should be glad to have such a list. That is what we want; and the experts in this business are the only ones who can furnish it to us.

Mr. J. B. Smith—It would be of great advantage to Canada.

Hon. Mr. Wallace—We must try and interpret the Act as liberally as possible.

The deputation, having thanked the Hon. Mr. Wallace for his courteous hearing, then withdrew.

QUARTERLY MEETING.

MONTREAL.

FRIDAY, 7TH APRIL, 1893.

The Spring quarterly meeting of the Association was held in the new club room, Windsor Hotel, Montreal, on Friday, 7th April.

There were present :

Capt. R. C. Adams (Anglo-Canadian Phosphate Co.), Montreal.
L. A. Klein (American Asbestos Co.), Black Lake.
J. Burley Smith (British Phosphate Co.), Glen Almond.
S. P. Franchot (Emerald Mining Co.), Buckingham.
R. T. Hopper (Anglo-Canadian Asbestos Co.), Montreal.
Prof. B. J. Harrington (McGill University), Montreal.
F. Cirkel (Templeton Asbestos Co.), Templeton.
W. H. Jeffrey (Danville Asbestos Mines), Montreal.
Thos. W. Gibson (Bureau of Mines), Toronto.
Theodore Doucet, N.P., Montreal.
F. A. Halsey (Canadian Rand Drill Co.), Sherbrooke.
John M. Jenckes (Jenckes Machine Co.), Sherbrooke.
George R. Smith (Bell's Asbestos Co.), Thetford Mines.
John J. Penhale (United Asbestos Co.), Montreal.
— Dickson, Montreal.
A. W. Stevenson, C.A., Montreal.
F. D. Taylor, Montreal.
E. W. Gilman (Ingersoll Rock Drill Co.), Montreal.
Daniel Smith (Hamilton Powder Co.), Brownsburg.
B. T. A. Bell, Secretary.

At the afternoon session a number of students attending the mining classes at McGill University were present. The morning session opened at 10 a.m.

The Hon. George Irvine, Q.C., president of the Association, owing to family bereavement, was unable to be present, and Capt. R. C. Adams, was called to the chair.

THE DUTY ON MINING MACHINERY.

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CAPT. ADAMS—Perhaps the Secretary will present the report of the deputation appointed at last meeting to interview the Government respecting the duty on mining machinery?

MR. B. T. A. BELL—The deputation appointed by the Association had an interview with the Hon. Mr. Clarke Wallace, Comptroller of Customs at Ottawa, on Wednesday, 9th March. We were given a courteous hearing and the Comptroller was apparently interested in our objections to the operation of the present law brought under his notice. I undertook, on behalf of the Association, to prepare a statement for reference in the Department, showing the classes and kinds of mining machinery made in Canada, as well as a list of those specialties which we knew were not manufactured and which have to be imported. With a view to giving our home manufacturers an opportunity of fair representation, I addressed a circular letter to each, asking for returns of their manufactures and I also invited them to be present at the discussion this morning. Since the question has been brought up at this meeting I do not think there is any necessity of going into any resolution asking for free importation of machinery, because the Dominion Government will not entertain such an idea. The question comes up, is the imported plant simply for mining purposes? Blast furnaces and gold mills and metallurgical works are manufacturing interests all intimately co-related with mining, but according to the definition of the Act, are excluded from free imports of machinery. A full stenographic report of the interview was taken and perhaps it might be interesting to have it read.

MR. S. P. FRANCHOT read the stenographer's report of the interview with the Hon. N. Clarke Wallace and also the list of mining machinery fyled in the Department of Customs by the Jenckes Machine Company, Sherbrooke, and which, officially endorsed by the late Commissioner of Customs, Mr. Johnson, was used by the Government as a reference at ports of entry.

MR L. A. KLEIN stated that he had at a recent period wanted a Blockhole drill and that he wrote to the Canadian Rand Drill Company for it.

The company replied that very few of those drills were made, that they would have to get it for him from their house in New York, and that he would not be able to get it at such a satisfactory price as otherwise, as they would have to pay duty on it. Mr. Klein stated that he favored requesting the Government to allow mining machinery to come into Canada free of duty.

CAPT. R. C. ADAMS moved that: "Whereas the Dominion Government have stated that they are contemplating a revision of the tariff and that, looking to this end they have invited information upon the subject; and whereas the best interests of the Canadian mining would be conserved by the removal of all duties upon mining machinery: Therefore be it resolved that the Dominion Government be respectfully requested to consider the practicability of granting this benefit."

MR. S. P. FRANCHOT seconded the motion, which was carried.

MR. HALSEY said; I may say in relation to Mr. Klein's remarks that the special drill he asked for is a little drill which we had never before been called upon to furnish. His application has been the only one of the kind in our experience: and I may say in point of fact made the only case which would have necessitated our importing machinery. One thing more. In the report of the interview with the Customs Department just read, the name of the Daw drill was mentioned as one of those wonderful machines. I have had full drawings and specicifications of that drill made and I want to say distinctly that no man in Canada or any where else who has had a Rand or an Ingersoll in his mine would have a Daw; and that applies to many other kinds of imported machinery.

MR. B. T. A. BELL moved: "That a special committee, representing the mineral operations of the province, consisting of Mr. L. A. Klein, Mr. John Blue, Mr. J. Burley Smith, Mr. George R. Smith, Mr. S. P. Franchot and himself, with an equal number of gentlemen representing the manufacturing interests of mining machinery in Canada be appointed to frame a statement of mining machinery not manufactured in Canada, and that the said statement be submitted to the various Canadian mining associations for approval before being finally submitted to the Department for official reference."

Mr. John Penhale seconded the motion, which was carried.

The meeting then considered and adopted several important amendments to the Constitution and By-laws and adjourned at one o'clock.

AFTERNOON SESSION.

The members re-assembled at half-past two o'clock, the club room being filled. Capt. R. C. Adams, Vice-President, who occupied the chair, called for the first paper on the programme, entitled :

MICA DEPOSITS IN THE COUNTY OF OTTAWA.

By Mr. F. Cirkel, M.E., Ottawa.

The mineral mica has assumed last year such considerable and economic importance that the attention of mining men and capitalists is directed at present very much to the mining of this mineral. Although the presence of the brown or so-called amber mica in the province of Quebec has been known for very many years, but little value was attached to it, the uses for the mineral and the market being exceedingly limited. Phosphate mines, worked formerly on a large scale, have yielded sometimes considerable quantities of mica, but the latter was thrown into the dump on account of it being considered as worthless. This brown or amber mica, a magnesia mica of the phlogopite species, occurs in scaly particles as an essential constituent of many eruptive and metamorphic rocks, such as gneiss, granite, porphyry, etc., and in this mode of occurrence it is only of geological or lithological importance ; but as an economic mineral, as a mineral of commercial value, as which it may come here in consideration, we have to refer to the deposits of mica, more nearly related to the limestone and pyroxene groups of the Laurentian system.

The principal areas where those phlogopite mica deposits are to be found in the province of Quebec, are confined to the Ottawa County, and more especially to the districts of Wakefield, Templeton, and the Lievres. It occurs chiefly in the pyroxene rock which traverses in great masses the crystalline limestone, and forms crystals, aggregates of crystals, pockets or veins in great irregularity. Single crystals of every size, from a few inches up to two and three feet in diameter, are found imbedded and distributed irregularly over the whole rock; they are for the most part complete in their structure, afford occasionally limestones of two feet square, the sheets being free from wrinkles and crevices, and therefore of great economic value. Very often we see them associated together in aggregates, in pockets or deposits of highly irregular form and shape. In this form they are pocketed close together, cemented occasionally by crystalline limestone, penetrating and replacing each other, and appear therefore in a much contorted and twisted state. These pockets or aggregates are mostly in connection with each other by chains of small sized crystals and in the adjacent rock we find very often a large amount of crystals distributed. In following these chains many valuable discoveries of large mica masses have been made in considerable depth. The third kind of occurrence, and which is the most important from a mining point of view, is the vein-like occurrence. We hardly can say that the mica occurs in veins itself as it is for the most part an intimate connection of pockets and larger masses of mica crystals. These deposits resemble each other in many respects. Their general outline is approximately lenticular, as can be seen from surface indications and vertical sections in considerable depth. Veins of this class are found traversing all the strata, they are most frequently vertical in attitude and cut the bed in nearly every direction. They exhibit within certain limits great variations in their geological character not only in different deposits, but in different parts of the same deposits. While some consist of nearly pure mica crystals, others will be found to be characterized by an admixture of grains or small pockets of apatite, pyroxene, feldspar or carbonate of lime either alone or variously associated and sometimes in such quantities as to make up large portions of mica deposits. We observe occasionally a certain regularity in the vein-like deposits as far as the dip, the width and the horizontal extensions, but this feature is to be considered as seldom. On lot 15 in the 11th range of Templeton, there were on the surface two vein-like deposits, with small contorted crystals in a distance of about 10 feet, the walls being parallel, in width from two to four feet; the same were tested by a shaft and in a depth of 15 feet those two bodies came together, forming a single vein of eight feet wide and crossing the whole size of the shaft; this vein continued most regularly in the shaft and in about 25 feet a large phosphate body was struck, the veins split up and the crystals being distributed over the whole body; the same were large sized and most regular in their structure. yielding a great amount of flat sheets. Mica crystals frequently line drusy cavities in fissures; they preserve in this mode their sharpness of ontline, and are for the most part not contorted. Their regularity and frequently large dimensions serve to distinguish them from the crystals of the other modes of occurrence.

Taking all observations together, we must say that we have a great variation in the occurrence of mica deposits; we find in one and the same belt very frequently all the different modes, as single embedded crystals, as aggregates and as pockets and veins, and it is difficult to say which mode of occurrence is a characteristic feature for one or the other pyroxene belt. We see for instance in Lot 15, Range 8, Templeton, all kinds of deposits represented; we find in an open cut in a mountain ridge well defined single crystals, aggregates of crystals, vein-like deposits, some of them being of elliptical section. For the most part however we can say that the mica deposits occur as lenticular masses, frequently interrupted by the country rock.

On account of the great irregularity and the variation of occurrence, surface indications are not sufficient to give a judgment about the value of mica deposits, as many of them prove of superficial character; they have to be opened up and in considerable extent developed, especially in depth, in order to gain a knowledge of their nature. In many cases we find that the soil contains a considerable amount of mica crystals, but there is no leading feature to determine with certainty that also the underlying rock likely contains mica deposits. This has been observed in several places, especially on mountain slopes, and is due to the weathering process in nature and action of water-streams, which in course of time excavate the superficial deposits and place laminæs of crystals in lower levels. Further we notice that the mica appears in a much contorted and twisted state in a most shattered rock, sometimes in very large extent. Such deposits cannot be considered as worthless, as we know that all rocks are constantly undergoing decomposition and decay; in these cases sufficient development to the depth must be made in order to gain a knowledge of the conditions in the sound rock and we observe that deposits with contorted mineral on the surface have proved in many cases very valuable in lower levels.

As for the conditions of the deposits in the depth we have to refer here to the investigations made at different mines in the Templeton and Wakefield deposits. In these mines valuable deposits have been found in a depth of 150 to 250 feet, of the same nature as described above and these investigations have shown that in nearly all cases there is a leading connection between the lenticular and veinlike deposits. And with regard to the gneisses of those deposits we can state that the nature of the latter in the depth must be the same as observed in higher levels.

Concerning the quality of the amber mica, it has been stated by experts that it is well adapted for all purposes, which mica of foreign countries has been used for hitherto; it has a yellowish color with pearly metallic lustre. Chemical analyses have shown that the darker mica contains more iron than the lighter colors, and it may be that this has an influence upon the uses of the darker species for electrical purposes. The regular, well defined, six sized crystals are for the most part obtained from cavities, while the crystals from aggregates or large sized pockets do not prove as valuable for commercial purposes, in being much contorted. The laminæs of the large sized crystals hold sometimes between them plates of calcite or quartz, or flakes of plumbago. In one case a well defined crystal of apatite was found imbedded in a mica crystal, which had evidently crystallized around it.

On account of the irregular distribution of the deposits and the shattered and contorted condition of the mica itself it is evident that the bulk of rock and waste mica, necessary in order to obtain one ton of merchantable mica is great and with regard to the varied methods adopted in the different mines it is difficult to get reliable details, so as to make out the exact average cost of production of the merchantable mica. As for the percentage of cut mica in the run of mine, the figures obtained differ greatly; in one mine there were cut out 5,500 lbs. mica.

50 lbs.,	4 x 6 inches	and higher
125 lbs.,	3 x 5 "	"
1500 lbs.,	2 x 3 "	"

or altogether about 30 per cent.

THE INDUSTRIAL USES OF MICA.

By Mr. B. T. A. Bell, Ottawa, Ont.

During the past three months, as most of you know, I have had my hands more than full, and I would therefore crave indulgence if the bald and unpretentious notes which I now submit fall far short of the requirements of a paper dealing with a subject of so much interest and importance. I have simply noted roughcast from such sources as were at hand, a few features of the mica industry which I have thought might be useful in supplementing the papers presented to-day by the other members. In doing so it may not be out of place, considering the importance of our market, in the United States, to glance briefly at the outset at the mica industry of that country.

Occurrence in United States—The localities at which mica occurs in an available form are not numerous and its production has been confined to the States of North Carolina, New Hampshire, Virginia and South Dakota. It is also known to occur in Wyoming and Washington but no development has taken place.

Mica Mining in North Carolina—In North Carolina the mineral has been mined since 1868. In the fall of 1867, says Mr. W. B. Phillips, (Mineral Statistics, U.S.A., 1885), General Clingman was was told by a New York dealer in mica that a good quality was then so scarce that he had been obliged to pay as much as $8.00 per pound for some small sheets. This induced the General to institute a search for good mica in North Carolina. He began work in the latter part of 1867, or early in 1868, and from Cleveland county obtained several barrels of good mica which he sent to New York. A little work was done in Rutherford and Burke counties, but with no satisfactory results. Having an intimate knowledge of Mitchell and Yancey counties, he decided to prospect there. In his own words "I selected as the best points for work the Ray mine, Yancey county, the Silver mine, and Buchanan mines in Mitchell county. It was my singular good fortune to choose the very best of three mines that have since been found most valuable." General Clingman then returned to New York and made an agreement with Messrs. Sloan & Mendon, of Liberty street, to engage in the mica business together, and Mr. Mendon came out to North Carolina and visited the Ray mine. Not being impressed with the outlook however, he returned home, and shortly afterwards, together with Mr. Sloan abandoned the enterprise. General Clingman carried on the work alone at the silver mine, and got out several hundred pounds of mica. Being obliged to leave in order to attend to some more pressing business, he instructed his foreman to collect all the mica and store it away. This, however, was not done, and several large block were left on the ground. A stock drover passing that way with his wagon picked up one of these and carried it to Knoxville, Tenn. There it was seen by Mr. J. G. Heap, of the firm of Heap & Clapp, dealers in stoves and tinware, who at once recognized its value. Disposing of their business they went at once to Mitchell county and began mica mining. This was in 1869. For several years they conducted a very profitable business, realizing for some of the mica as much as $11 per lb. For several years the business was carried on quietly.

Mine Production in United States—Prof. W. C. Kerr, (Min. Res. U.S.A., 1882), estimated that the production to the end of 1881 was 400,000 pounds valued at $800,000. In 1887 it was estimated that the total value of the production in North Carolina from 1868 to 1887 amounted to 762,400 pounds of a total value of $1,608,500. Since then the production has steadily declined. In 1884, it was estimated at $253,000; in 1889 it had dropped to 6,700 pounds of a value of $7,000. The average depth of the mines is quoted by Prof. W. C. Kerr, at 75 feet, only two, the Clarissa, 3½ miles east of Bakersville, Mitchell county, and the Flat Rock in the same neighborhood, having attained a depth of between 300 or 400 feet. Nearly all are worked by shafts, vertical or underlie. Steam power until very recently being used very sparingly, most of the hoisting being done by horse-power.

A better idea of the retrogressive nature of the mica industry in the United States may be gathered by a comparison of the United States Census Statistics. In 1880 there were in that country 78 mica mines, 71 of these being in North Carolina; of these 78, 22 were worked, 17 of them in North Carolina. The invested capital was $337,900, $6,900 being in North Carolina; total number of hands employed 272, in North Carolina 177; total paid in wages $65,000; total production

81,669 pounds, valued at $127,825; North Carolina producing 42,669 pounds valued at $61,675.

In 1889 only a small number of mines were operated, and few of these were worked steadily. Of a total product of 49,500 pounds of cut mica, valued at $50,000, and 196 short tons of scrap, valued at $2,450, one mine in New Hampshire produced 40,000 pounds, valued at $40,000, and 160 tons of scrap valued at $2,000. Of the North Carolina mines none were in steady operation, and the production of that State, aggregating 6,700 pounds, of a value of $7,000, was the result of irregular and spasmodic efforts. The balance of the product, viz:—2,800 pounds of cut mica valued at $3,000, and 36 tons of scrap came from one mine in Virginia, which was exhausted early in the year. In the Black Hills region, South Dakota, where, in 1884, eleven mines were in operation with a production of over 18,000 pounds of mica, only one produced in 1889 and that only a small amount. The whole industry employed but 174 persons, and $58,335 was expended in wages, supplies and other outlays.

In 1882, cut mica was worth $3.50 per pound; in 1883, $2.50; in 1884, $2.53; in 1885-6-7, $1.75; in 1889, a fraction over a dollar; in 1890 there were signs of improvement and the total product in the United States aggregating 60,000 pounds, was valued at $75,000; in 1891 it had increased to 75,000 pounds, of a value of $100,000.

Imports of Mica into the United States—In October, 1890, the McKinley Tariff placed mica on its dutiable list at 35 per cent. *ad valorem.* Notwithstanding this protection the imports into the United States in that year were more than double that of any previous year, having increased from $1,165 in 1869, to $9,274 in 1879, and $97,351 in 1889 to $207,375 in 1890. A comparision of the sources from which the United States draws its supplies, may be gathered from the following returns for the year ended 30th June, 1890:—Germany, $3,500; England, $64,611; Canada, $25,105; British East Indies, $49,058; Sweden and Norway, $4,695.

Mica Production of Canada—On the other hand the value of the production in Canada has steadily advanced, as may be gathered from following figures quoted from the returns of the Geological Survey of Canada: 1886, $29,008; 1887, $29,816; 1888, $30,207; 1889, $28,718; 1890, $68,074; 1891, $71,510. For the twelve months ended 31st

December last year (1892) the value of the exports from Canada had increased to over $100,000, of which the Ottawa district contributed no less than $54,729.82 to the United States.

This leads me to note briefly some of the uses to which the product is applied.

Stove Panels—In 1879 when I first became associated with the industry through my connection with Mr. E. Grant Powell, of Ottawa, at that time agent for the sale of the product of the British and Canadian Mica and Mining Company's mine in the township of Villeneuve, Ottawa County, Que., manufacturers of stoves in Canada and the United States consumed 95 per cent. of the output. The Villeneuve mine in Ottawa county, and the properties worked by Smith & Lacey at Sydenham, Ont., were the principal producers, though several surface deposits were opened by farmers, who worked them occasionally when business was dull, and realized fair profits on their production. It was then almost wholly utilized for the pannelling of stove and furnace doors. For this purpose it had to be clear, free from spots and of a uniform color throughout the sheet.

Electrical Insulation—The great factor in increasing the consumption of mica has been its demand for electrical purposes. "The insulating power of mica," says an eminent electrician, "is superior to that of any other substance applicable to armatures. An advantage, peculiar to itself, is its even laminated structure. How wonderful is the thinness of its individual layers! A piece of ordinary writing paper is about .005 inch; mica layers have been obtained of a thinness of .00003 inch. Mechanical difficulties prevent its being split thinner. By passing it upon a hard surface and splitting it off as much as possible, the remaining fragments are so thin as to become beautifully irridescent. The builders of armatures can therefore split the sheets into any desired and uniform thickness with great ease and accuracy. An interesiing property of mica and one not generally recognized, is its homogenity of structure and clear transparency, although so black when thick. A valuable property of mica in connection with commutator insulation is its proper degree of hardness, whereby it does not wear away too rapidly under the action of the brushes. If rubber was used for example, even if it did not burn, yet it would wear off and sparking result, because the commutator surface would not be truly cylindrical. The brushes would be set into vibration.

"Again, mica is capable of the finest pulverization, so that any wearing which does take place does not result in the liberation of gritty particles, which would cause sparking. Such mishaps occur with hardened artificial plastic insulators. The insulation should be just so thick that the current cannot jump across from one section to the other."

"Of all substances," says the same authority, "mica is probably the best material for use in armatures, if it is desired to obtain not only efficient electric insulation, but also durability under the influence of heat. The highest temperature to which an armature is subjected, even by short circuit or bad construction, will have no injurious effect on mica. Mica, thick or thin, may be held in a glass flame without burning or melting. It remains unaffected."

The introduction of mica into practice appears to have been brought about in the following manner :—An accident would happen to an armature, and before the next night it must needs be repaired. In order to make the temporary remedy, mica sheets or bars would be interposed. In case of subsequent accidents the portion repaired by mica was the last to yield. Therefore it was proposed to build the armature primarily with mica.

Mica for electrical purposes must be flexible and non-conductive, color does not matter, but perfect cleavage is of the highest importance as "electrical mica" must be of uniform thickness, and is often guaged to the thousandth part of an inch. The size of sheets vary greatly, 450 different patterns having been called for. The price is from 10c. to $2.50 and upwards per lb. and varies with the size of the sheet and difficulty of cutting the pattern.

The Canadian mica, on account of its superior cleavage, is preferred by electricians in the United States to the home product, and after gaining a foothold in the American markets it has more than held its own against the local and foreign product. An instance of this may be cited in the following communication to the Geological Survey of Canada from the Edison General Electric Company of New York (See Annual Report Mineral Statistics, 1890, pp. 104 and 105 s.), which says: "The bulk of mica used by us is Canadian mica, which is known in the market as 'amber mica,' being of amber color and clear. It is essential that

the mica should be smooth, free from wrinkles and crevices, it must split readily and must be flexible, so much so that a piece of mica .010 in. thick would bend to a curvature of about 3 in. diameter without cracking. Mica that has dark spots or spots similar to rainbow colors, or what is known as smoky mica, is not at all suitable for electrical purposes. Mica must also stand a flame of intense heat without crumbling up or showing any disintegration. We give you below the principal sizes of mica used by us, and would say that at the present time we have orders out for some of the sizes ranging from 200 to 600 pounds:—
Commutator mica: 1½ in. x 4 in., 1¼ in. x 6⅝, 1⅝ x 4¼, 1⅜ x 6½, 1⅜ x 8, 1¾ x 8, 2 x 5, 2½ x 5, 2 x 7, 2 x 12, 2½ x 12, 4 x 4, 5 x 8.
Binding mica: 1¼ in. wide."

Micanite—One of the most recent uses to which mica is commercially applied is the manufacture of micanite, by which large quantities of scrap or inferior qualities are utilized, and by means of a patented process small pieces of waste mica are built up into sheets 40 inches square, and larger if necessary. The product can also be made in any desired form, and is largely supplied to the electrical trade for insulating purposes. In a paper read before the American Institute of Electrical Engineers, a Mr. Thompson, in discussing the merits of micanite, said: "Superior for armature insulation, mica is, in its natural structure accompanied by certain objections, which, in trying to overcome, were more serious than had been anticipated, as it was not until after a long series of trials that a successful article was produced, and not until a novel apparatus for cheapening the process of manufacture was devised. The apparatus is now in operation on a large scale."

He claimed first—Mica, as found in nature, occurs in flat sheets only. It has a high degree of elasticity, so that when once bent and released, it assumes its original form. If folded, its brittleness causes fracture. If the natural sheets are compressed in a mold, to try to form armature insulator heads for instance, it is completely broken up.

Secondly—Natural mica sheets correspond financially to plate glass. The larger the sheet, the higher the cost per square inch. Mica in small pieces, from four to six square inches, is exceedingly abundant and very cheap. It is often called waste mica, because very limited in its uses, and consisting often of trimmings from larger and more useful sheets. In medium and large sizes of armatures, the naturally built up mica is so expensive as to be ojebctionable, although not so much so as to entirely prevent its employment.

Thirdly—Between the hundreds, nay, thousands of thin layers, damp air can enter, and also water, accidentally, which cannot easily or effectually be removed.

Fourthly—Mica splits so easily that handling causes injury.

Fifthly—Mica cannot be cut transversely to advantage. The edges are unworkmanlike, being ragged and jagged. Neatness in drilling, sawing and turning is difficullt.

Among the attempts which have been made to overcome these objections are those involving the use of pulverized or comminuted mica, which is mixed with a liquid cement and stirred into a paste. While still soft, the mixture is rolled or compressed into any desired form, as if consisting of so much plaster-of-paris. In order to give it sufficient strength, one-third of the product is cement. The mica sparkles here and there on the surface, as it glitters on granite. This article should be called a cement insulator, and not a mica insulator, because the current can flow in a straight circuit through the plate without encountering any mica. The cement forms numerous rectilinear paths for the current, independently of the mica; and therefore the product is in no sense an equivalent of mica.

A modification of this type of insulator consists of a coarse and thick textile fabric, whose pores and meshes are filled with a mixture composed of comminuted mica and a suitable adhesive substance. Another consists of finely divided asbestos mixed with pulverized mica, silicate of soda, and sulphur compounds. It is molded by pressure into any desired form.

The comminuted mica-cement type is useful in trolley wire supports and similar insulators, but for dynamos it is useless not only for the reason stated, but because of its softening and running under slight heat, being so necessarily rich in cement. If the cement is that kind that chars, the mica crumbles apart. Mineral powders have been mixed with it, to render it more fire-proof.

An example of the manner of using non-comminuted mica between the core and the windings consists in covering the core with paper, laying sheets of mica over the paper, then laying on another sheet of paper, fastening the whole together by convolutions of cord or similar ligatures, and finally applying the coils. During operation, the paper and mica may shift from their positions, and thereby affect the rigidity of the armature as a whole. Again, the process of applying the pieces, and keeping them temporarily in position, requires repeated efforts and results in a display of crude workmanship."

Mica for Glasses and Spectacles—The best employment of the immense quantities of scraps and fragments of waste mica which suggests itself as worthy of a wider field than it now possesses is the substitution of mica for glass in spectacles worn by workmen, especially stone and metal workers, to protect their eyes from chips and splinters. As already made in Germany, these mica glasses are concaved in the shape of watch glasses, and are about one twenty-fifth of an inch in thickness. The advantages gained by this utilization are greater than would at first be imagined. Mica spectacles cannot be broken. Pounding with a sledge hammer merely flattens them, nor does molten metal poured on the mica affect it. The shower of pointed iron particles which issues from lathes merely rebounds from the elastic mica glasses.

Paints, Wall Papers and Ornamental Uses—Another use for mica is its application, when previously colored or metalized, to ornamental purposes. From its unalterable nature the material preserves gilding, silvering or coloring from deterioration; and from its diaphanity, the articles so treated will preserve all their brilliancy. Finely ground mica, or colored gelatin, also shows handsome effects, and when mixed with a solution of gumarabic, it makes a good silver ink. The gelatin combination is used for inlaying buttons. Another beautiful application of mica is the production of bronze-like colors, which bear the names brocades, crystal colors and mica bronzes. Among the advantages of these are that they are indifferent to sulphurous exhalations, are very light in weight, and in some colors are even more brilliant than the metal bronzes. When small particles of mica silver are spread over articles coated with asphalt varnish, the result is a good imitation of granite. The crystal colors are also suitable for calico printing; and the fabrics to which they are applied surpass in brilliancy the heavy bronze and glass dust fancy fabrics of Lyons. Such colors have been used to decorate porcelain and glassware, the articles undergoing a second heating up to the fusing point of their glazing. By suitable dyes, the material is colored to a variety of hues.

As a Lubricant—The mineral is somewhat extensively used in the manufacture of mica grease. As a lubricant for railroad purposes its value lies in the fact that it is absolutely anti-friction, and it is claimed with its use hot boxes or journals are simply impossible

Other Uses—Mica has been used on board war vessels, in localities where glass would be broken by the concussion due to the firing of heavy guns. It is made into reflectors, sea compasses, inlaying for wood instead of enamel. It is also employed for roofing purposes, and in several patented processes forms a water and fireproof covering for strata of rubber, tar, canvas, felt, and similar materials. Its most recent application in a powdered state, is to the so-called wax-printed cloths as shown at the World's Fair, Chicago. These cloths are made by applying melted wax to the cloth with a stick in free hand designs, and before the wax is dry powdered mica is sifted over it.

Ground Mica—In recent years the preparation of ground mica has become an industry of itself, and several United States' firms have gone into the business. Waste or scrap mica is generally used. The difficulties of grinding are great, owing to the tough and scaley nature of the material. Mills which work well on almost everything else fail utterly on mica. Recently there has been a return to old-fashioned burr-stones, though most of the manufacturers keep their process a secret. The grinding is usually wet. Some manufacturers grind mica to a very fine powder for "specialties," but the sizes of ground mica usually made are 24, 40, 60, 70, 80, 100, 140, 160, and 200 meshes to the inch, and the prices range from 5c. to 10c. per pound. Scrap mica for grinding is bought for about $12 per ton at the mine. It must be free from rust or specks, which would affect the color and lustre of the product.

Preparation for Market—Care is taken in mining to avoid drilling through the mica crystals, or to break them unduly. The mica thrown down by blasting undergoes a preliminary hand-dressing underground. It is then taken to the "mica shop," where it is split with knives into sheets of the required thinness, and afterward sheared into sizes. The workman has on his bench a stationary pair of shears and a large number of blocks or templates of the sizes to be cut. An experienced mica-cutter can tell at a glance the largest size which can be cut from a given piece of split mica; he selects the proper template, holds it on the mica, and shears the four sides, using each edge of the block as a straight-edge. Each size sheared is set away by itself. The sheets are sheared by further scaling, if necessary, and finally packed in paper in pound packages. At the factory of the Lake Gerard Mica Mining System in Ottawa, this hand labor is greatly reduced and a great saving effected by the use of patented cutting machines operated by electricity. This company has twenty-three power presses for cutting irregular shaped dies and segments. They are of American manufacture; twenty of them from the E. W. Bliss Co., Ltd., of Brooklyn, N.Y.; two made by the Ferracute Machine Co., of Bridgeton, N.J.; and the other manufactured by the Long and Allstatter Co., of Hamilton, Ohio. Eighteen of the Bliss machines are the well known Bench presses and specially suitable for cutting patterns most in demand at the present time. The dies used in this factory are the most complete at present in use for the this purpose, and include some sixteen different patterns, ranging in size from 5¼ x 10 in. to ⅞ x 3 in., and with a few exceptions are all made in Ottawa. In addition to the cutting presses already mentioned, there are in use ten cutting shears for two-siding and cutting material of unusually large size. The production of merchantable sheets is usually from 4 to 5 per cent. of the block mica brought from the mine, and may run as high as 8 or 10 per cent.

DISCUSSION.

THE CHAIRMAN—We are much indebted to Mr. Bell, for this valuable collection of information on the subject. Mica has excited a great deal of interest among us, in coming in when the phosphate industry was declining; and as it has come in in connection with the phosphate we have been tempted to throw it away. I remember selling 200 tons of it for 75 cents a ton, while now the better kinds bring from $300 to $400 a ton. We have heard from Mr. Bell several of its uses, and no doubt several more uses to which it can be put will be discovered. I met a gentleman who told me that a certain distinguished professor had said that mica was sure to become an important factor in the industries of the future; and this remarkable discovery as an insulator for electrical purposes certainly opens a wide field in that direction.

There is a general feeling among miners of Ontario who have had to do with phosphate that mica does not, as they say, "go down." I think it would be as well to hear from some of the practical miners here upon that point. Perhaps Dr. Ells can give us an opinion even better than the practical men. It is the coming industry in some of our sections of the country, and we would like to know what we can hope for

Mr. Higginson—With regard to the depth of mica, we have found within the last three weeks mica at a depth of 225 feet from the surface in our phosphate beds, and several of the crystals at that depth were 18 inches by 2 feet in diameter.

Dr. Ells—So far as I know, the occurrences of phosphates are very closely identified with pyroxene dykes, and these dykes are deep, so that there is no reason why mica should not occur at great depths. In the case of the Villeneuve mine, the conditions are precisely the same as those of the phosphate in the pyroxene dykes. Mr. Franchot mines within 10 feet of the gneissic deposit alongside.

Mr. Hopper—The Sydenham mica people, I understand, get their best mica at a depth of 200 feet.

Mr. Franchot—Capt. Watters gets his best mica at a depth of 250 feet.

Messrs. J. Burley Smith, S. P. Franchot and Theo. Doucet also discussed the paper. Prof. Harrington, of McGill University, contributed an interesting address on some of the scientific aspects of the mineral.

THE IRON ORES OF FRONTENAC AND LEEDS, ONTARIO

By MR. J. BAWDEN, Kingston, Ont.

The counties of Frontenac and Leeds form the southerly half of an extensive iron ore district, the northerly half of which is made up of the counties of Lanark and Renfrew. The latter portion is not of less interest, indeed there is reason to believe it the richer field of the two, but the greater accessibility of the frontier field by means of the Rideau Canal and the Kingston & Pembroke Railway, and the greater attention given to its features, induce the writer to confine these notes to a summary of what has been learned in the course of mining operations in the district under consideration.

In a series of Canadian Geological Survey Reports covering the period from 1870 to 1875, the late Henry G. Vennor gave the results of his labors in Frontenac, Lanark and Renfrew. Prefacing his conclusions with the remark that in the then "imperfect state of knowledge respecting the Laurentian rocks proper and those which immediately follow, or interpose between them and the lower Silurian formation, any positive assertions as to the relative age of a large portion of those examined by him would be hazardous," he groups them under six divisions. (See Report for 1844-5, p. 122 etc.). He states his doubt, however, as to their stratigraphical order and whether they represent one or more formations.

Approaching the highest member of Vennor's series the outcrops of the Potsdam formation occur, referred to in Logan's report for 1863 as extending from the Straits of Belle Isle to the west side of Knowlton Lake, Loughborough township, a distance of 1,000 miles. This formation appears more extensively in Leeds than in Frontenac. Along its outcrops on the shores of Charleston Lake, and other lake expansions of the Rideau Canal, and on islands in these waters, red hematite ore is met, but in what quantity no thorough exploration permits the statement. The same ferruginous outcrop extends across Frontenac from Dog Lake in Storrington to the middle of the rear line of Portland, attended at several points with deposits of the same ore. The existence of red and brown hematite in Kennebec, the topography of the south-western part of Hinchinbrooke and local reports, support the presumption that the frontier of the Potsdam sandstone extends throughout Leeds and Frontenac, a distance of 80 miles. In Lansdowne, Storrington and Loughborough, it is crossed by calcite dykes or veins carrying galena and baryta. On its northern boundary, the formation throughout a great part of its course appears in the vicinity of an extensive hypersthene gabbro, with veins and lenses of apatite, pyroxene and black mica.

The red hematites of the Potsdam formation appear superficially to be altered pyritous deposits. A sample from lot 19, 9th con., South Crosby, gave 28.14 iron; from lot 2, 7th con. Bedford, 32·30 iron; Ph. 1·02; from lot 7, 10th con. Portland, 68·58 iron. I am indebted to the Bethlehem Iron Co., who purchased 30,000 tons of ore from the Wallbridge mine, Hastings, in 1882, for several analyses, the mean of which is as follows:—

Fe	48·278
Si	21·73
MngO	·251
Mg	1·833
Al	1·175
CaO	6·67
P	·036
FeS	1·62

The extremes are, Fe, 36·62; Si, 41·47; Fe, 56·9; Si, 9. The minor constituents are almost invariable. This ore is found with a boundary of dolomite on either side, similar to the position of the ore on lot 2, 7th con. Bedford. The occurrences of hematite north of the Potsdam formation so far discovered are few. One of specular ore on lot 1, 9th con. Palmerston, lies at an elevation above the Robertsville magnetic ore mine on lot 2, adjoining. The hematite occurrences are enumerated hereunder:

Escott—Lot 7, 2nd con.; lot 17, 6th con.

Lansdowne—Lot 13, 10th con.; lots 17, 18, 8th con., lot 20, 7th Con., rear of Lansdowne, lot 11, 12th con.

Bastard—Lot 23, 10th con.

S. Crosby—Lot 19, 9th con.

Limonite—Lot 1, 11th con., rear of Lansdowne, lot 21, 7th con., Bastard.

Loughborough—Lot 7, 9th con.; lot 25, 13th and 12th concessions.

Portland—Lot 7, 10th con.; lot 6, 14th con.

Bedford—Lot 15, 3rd con.

Palmerston—E ½ lot 1, 9th con.

Kennebec—Lot 11, 8th con.

The first furnace and forge built in Ontario at the beginning of this century, were supplied with ore from lot 11, 12th con., rear of Lansdowne. Tradition does not speak well of the character of the material made. Nevertheless the wide distribution of a ferriferous formation like the Potsdam and the little disturbance it has undergone in these counties, should encourage the search for hematite ores under the drift and alluvium wherever the least indication warrants it. If the ore grades low the time is perhaps at hand when it will be found economical to roast it, to render it susceptible of magnetic separation.

The magnetic ores of Frontenac and Leeds, as well as Lanark and part of Renfrew, are assigned by Vennor to synclinal lines in successive terranes distinguished by lithological characteristics. A locality not referred to by Vennor, extends from lot 5 in the 11th to 5 in the 13th Con., reappearing on lot 3 in the 13th con. of Portland. Whether this is all in one formation is as yet unknown. On lot 5, 13th con., the ore is said to be of good quality. On lot 3, 13th con. (485 ft. A.S.), a ferruginous quartzite, breaking with a diagonal cleavage, yields a varying percentage of ore. A somewhat similar ore on lot 2, 3rd con. of Bedford, gave the following:—

	(1)	(2)	(3)
Fe	71.75	51.	26.40
Si	4.20	22.2	....
Al	....	6.8	....
CaO	1.60	....	....
S	.70	....	....
P	....	....	0.032
MngO	.25	....	....
TiO_2	....	....	.872

In the next range (552 ft. A.S.) on lot 3, 3rd con., Bedford, a hard crystalline magnesian limestone accompanies the ore. At one opening the ore is disseminated in small grains through the rock, giving on analysis 23.70 iron, Ph. .009. On the same lot, a pit 8 feet deep, shows a vein 3 feet wide, samples from which gave Fe, 63.50; Ph, trace; Ti, .080; S, 105. This range has not been explored any distance.

The succeeding range, proceeding northerly, is the sixth in Vennor's series, the elevations in which are from 500 to 600 feet A.S. The range extends about twelve miles in Bedford, and if extended to lots in North Crosby, supposed to be in the range, is twenty miles in length. At its north-easterly termination in Bedford it is faulted between the 9th and 10th cons., and it would seem there are throws and displacements at several points near its south-west extremity. Here the ore is irregularly distributed through syenitic rock in bodies of more or less value. At 70 feet in depth, quantities of black tourmaline accompany the ore. About a quarter of a mile distant, the ore is found in dolomitic rock, in which it can be traced fully a mile, when the rock again changes character. The dolomite on the north wall gives place to hornblendic rock, and this changes again with the depth of the formation so as to lead to the belief that superficial overflows have changed the character of the overlying rock. In the further course of the range a remarkable development of schorlaceous schist enclosing crystals of black mica occurs on lot 9, 5th con. The ore mined on this range has presented varying characteristics, being remarkably pure during the earlier operations. It is for the most part highly crystalline, and has shown comparatively little sulphur until reaching the last few fathoms of work in the main shaft. The following assay is the mean of several analyses made for the Ohio Iron Co., of Zanesville, Ohio, the former lessees of the mine :—

Fe	62.73
Si	8.03
Mng	.58
CaO	.65
MgO	3.45
P	.0115
S	2.41
Ti	Trace

Five drill cores taken from the main shaft averaged 110 feet each of mixed greenstone and ore. The latter gave (mean of several analyses):

Fe	55.48
Si	8.04
Ph	.003
S	.0482
MgO	7.23
CaO	3.15
Mng	3.52
Al	.67
Ti	Nil

At Black Lake, lot 8, 4th con., with syenite footwall, greenstone hanging wall, the ore had the following average composition:—

Fe	
Al	62.03
Si	1.22
CaO	2.56
MgO	1.17
MngO	1.72
S	.63
P	.273
Ti	.0149
	.626

Between the range just noted and the next is a distance of 8 miles. The Eagle Lake range, the 5th of Vennor, probably extends from the K. & P. Railway westward some six miles, eastward 20 miles, approaching within 3 miles the C. P. R. line in Bathurst township. Analysis of this ore (Harrington's) gives:—

Fe	62.52
Al	.67
CaO	.33
Mg	.82
Ph	Trace
S	.07
TiO_2	3.28
Insol. res.	8.38

Apatite is disseminated in much of the ore in crystals and grains, the latter difficult of separation in the laboratory. The readiness with which titaniferous ores open up when heated to redness and thrown into water, as remarked by Auguste J. Rossi, makes it probable this ore could be concentrated to a high grade at moderate expense.

A large phosphate mine at St. George's Lake in Oso is the only mineral producer in a distance of 20 miles, lying chiefly within Vennor's 4th and 5th groups, until the Robertsville mine is reached. It is not to be inferred that this region is nonferiferous. On lot 17, 11th concession, Olden, magnetic ore is found which gives on analysis (Hoffman's):—

Ferrous oxide	28.975
Ferric "	68.46
Insol. res.	1.364
No Titanium	......

Magnetic ore is reported to be found on lots 11, 11th concession, 10 in the 4th concession and 7 in the 6th concession of the same township. West of this township brown and red hematite are found on lot 11, 8th concession, Kennebec within two miles of the C. P. R. line.

The Robertsville mine in Vennor's, 4th division, A.S. 665 feet, is on lot 2, 9th concession of Palmerstone. At 250 feet in depth the ore gave on analysis :—

Fe	57.17
Si	15.10
Al	.29
CaO	6.38
Mg	2.47
MnO	.40
S	.08

This mine was a producer for the Charlotte, N.Y., furnace, and it is said supplied selected ore, guaranteed to run 65 Fe, to a furnace at Pittsburgh. On an elevation on the lot adjoining (lot 1, 9th concession,) specular ore is found. Magnetic ore is found in the same range on lots 3, 5, 6, 10 and 11 in the 9th concession, 7 in the 10th and 21, 27 and 28 in the 11th concession of the same township.

West of Palmerston large bodies of magnetic ore are reported to be found in the townships of Clarendon and Barrie. No geological work appears to have been done on this range which is probably on the line of an extensive range of dolomite running north-easterly into South Canonto and thence into Lanark County. The extension of the Brockville and Westport Railway will serve to open up the property.

The magnetic ores of North and South Crosby are connected by Vennor with the feriferous magnesian limestones of Frontenac. He cautiously qualifies his statements however, as to the super-position and order of any member of the series. The principal locality is Chaffey's mine on an island in Mud Lake, lot 9, 6th concession, South Crosby, which has been a considerable producer and the ore is said to be cheaply mined. The following are analyses :—

Ferrous oxide	10.03	....
Magnetic oxide	60.57	69.77
Si	7.08	7.10
Fes_2	1.53	.....
Al	3.69	5.65
TiO_2	11.43	9.80
Ph	... .	.085
S	.82	1.52
MgO	4.96	4.50

In North Crosby, ore from lot 27, 4th concession, gives:—

Fe	65.27
Al	1.33
CaO	.82
MgO	.84
Ph	.007
S	.12
TiO_2	.12
Insol	1.03
	5.25

and ore from lot 2, 9th concession, South Crosby.

Fe	63.2
Si	6.8
S	.02
CaO	3.3
Al. and Mg	1.8

The work so far done by geologist and miner gives little information on which to predict the future of the mining industry of this region. It has been profitable only to sellers of mines. Whether in the event of the establishment of iron and steel manufacturies at Kingston, a permanent supply of good ore can be reckoned upon would seem to be unquestionable. But before accepting such conclusion on the basis of the meagre data at hand, prudence would dictate a very thorough examination of the ferriferous terranes which occupy so large a part of the district under consideration. The insane destruction of forest and soil by recklessly improvident free grant settlers, has removed hindrances encountered by Vennor, and rendered practicable the operations of the diamond drill, without the aid of which this extensive iron-ore district will never be able to satisfy reasonable enquiry into the permanence of its iron ore mines. Much may be done by roasting and concentration to place the discredited ores in the very front rank for furnace supply. Abundant water power at various points affords facilities for this enterprise, without recourse to which there is little prospect of any enquiry for dense refractory ores carrying sulphur, or phosphorus, or titanium, above objectionable points.

PEAT FUEL.

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By Mr. T. W. Gibson, Toronto..

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The uses of fuel may be roughly classified under four heads :—

(1) Domestic—cooking, heating, &c.

(2) The generation of steam for industrial purposes.

(3) The smelting of ores and refining of metals.

(4) The production of illuminating gas.

The substances which have hitherto been almost exclusively employed for these purposes in Canada, as in most other countries, are coal and wood, either in their natural condition or in the form of coke and charcoal. The use of petroleum and petroleum products is not unknown in Ontario, particularly in the furnaces of steam boilers, and recent improvements in the method of combustion have rendered this fuel of importance where distance from the source of production does not unduly enhance its cost. Natural gas has also begun to be used and is now in employment on a limited scale, both for manufacturing, domestic and illuminating purposes, but we are exporting for consumption in a foreign country as much as, or perhaps more than, we use ourselves, and the probability is that when we get ready to make use of it in earnest we shall find the supply very much reduced. Wood, as every one knows, is becoming scarcer every year, and increasing scarcity brings its natural result—increased prices. In some country districts in Ontario with which I am acquainted, the profusion of wood for fuel purposes which not long ago existed is now at an end. Of recent years such wood as maple has brought a higher price in the log than when cut into lengths for fuel, and the consequence is that farmers have sold their maple trees to saw millers and their tops and branches only to the users of fuel. These, of course, are inferior to the body of the tree, both for domestic and furnace purposes, and in such districts where wood was once the only kind of fuel thought of it is now a question as between wood and coal, with advantage in economy of price in some cases in favor of the latter.

Unfortunately, we have no coal in Ontario; at least none has yet been found in the southern portion of the province, though deposits of lignite are known to exist in the far off valleys of the Moose and Abbitibbi rivers on the Hudson Bay slope. The extent and value of these deposits are as yet unknown, as no systematic survey has been made with a view of determining whether or not they could be made available for economic use, but as they appear to occur in the drift it may be doubted whether they are likely to prove sources of important supply to the coal users of southern Ontario. At any rate they are yet far removed from communication and means of transport, so that were they ever so valuable they must for the present be left out of consideration. It is quite true that everybody does not agree with the geologists that we are below the coal bearing rocks in Ontario. It is natural to argue thus: we have been favored by Providence so highly in almost every other respect that it is almost inconceivable we should have been neglected in the matter of coal; consequently, we have heard in past years and still occasionally hear of discoveries of coal having been made in various parts of the province. Coal has been found at Collingwood, at Bowmanville and several other points. Some months ago a very valuable deposit was discovered—just to put the geologists to shame—not more than eight miles from the city of Toronto, and so precious is the bed to its owners that they have not yet been able to bring themselves to part with any portion of it, or even to raise it to the surface. No later than this week the Bureau of Mines was in receipt of a letter from a man who by means of a divining rod of his own construction had located a seam of coal eight feet thick in Western Ontario, which upon receipt of a suitable bonus from the government of the province he was willing to develop. The advisability of granting such a bonus, I need hardly say, remains under the government's most serious consideration.

But the lack of coal within our own borders leads to serious consequences. The coal we use comes almost wholly from the mines of Pennsylvania and Ohio, and whenever the gentlemen in control of these mines say "thumbs up" on the other side, thumbs have got to go up on this side. Were there even unrestricted competition among the producers of coal in the United States we could hope to get it in Ontario at the lowest price for which it could be profitably sold, but rings and monopolies govern the production and sale of this important article, and we are thus entirely within the power of foreign corporations who cannot be reached by Canadian laws, and who have "neither bodies to be kicked nor souls to be damned." Nova Scotia, the only other possible source of supply, has, unfortunately, been shown by experience to be too far removed from our markets to admit of our drawing upon it for any considerable part of our requirements. In view then of the increasing scarcity and dearness of wood, and of our coal supplies being in a foreign land and the subject of an odious monopoly, we are, it seems to me, in presence of a situation which demands our instant and most careful consideration. How are our private and public interests to be protected?

There are those who hold out the hope of escape from the situation by means of electricity, that force which has already done so much, and which is to solve every possible problem of transportation, lighting, heating, smelting and power. Fuel is not required, they say, for the generation of electricity where you have sufficient water power, and in the undeveloped rapids and falls of the upland regions of Ontario, where the head waters of the Muskoka, the Madawaska, the Petewawa, the Bonnechere, the Mattawa, the Severn, the Otonabee, the Trent, and many other streams take their rise, not to mention the immense potentiality of the falls of Niagara itself, lies the ultimate solution of the fuel question of Ontario. But while the grass grows the steed starves. There are many and great improvements to be made in the generation, transmission and utilization of electric force before these distant sources of power can be utilized for the ordinary purposes of every day life, and some greatly superior means of transmitting electricity through long distances especially is required before that form of force can be expected to supersede for all uses the chemical energy evolved by the oxidation of carbon.

In older countries where wood has become scarce and coal for various reasons unavailable, recourse has long been had to peat as fuel, both in the ordinary air-dried form and in a manufactured condition after treatment by various processes. In Ireland, Scotland, Germany, France, Russia, Norway, Sweden and every other European country where peat is found—and it occurs in almost every country lying within the temperate zone—a large proportion of the peasantry have for centuries depended almost entirely upon peat for heating and culinary purposes. I do not need to give any description of the ordinary method of cutting and saving peat, which is practically the same in all lands. It is cut with spades or tools of special form into brick-like blocks, which after sufficient exposure to sun and air become dry enough to burn. This is the method employed where a peat bog can be entered upon and dug with safety and convenience. Where the peat occurs, as it sometimes does, in a pastey or mud-like mass of little consistency, it is dragged or scraped out to firm land, and upon evaporation of the contained water it forms an article of fuel considered even superior to that produced from an ordinary bog. Air-dried peat, from a good bog, properly cut and saved, is by no means a despicable article of fuel. There are those, indeed, who have used it in the old land who do not hesitate to claim for it an equality with coal or wood. Doubtless, however, one of its principal advantages to the poorer people of European and other countries, is that it can be obtained at an expenditure of little more than their own labor. A family of growing boys with some assistance from the father or even the mother, can easily secure a year's fuel at the cost of a few days' or weeks' work. The fact that—as in Scotland—where wages have risen and increased facilities of transport have made coal available, the latter is preferred to peat, shows that on the whole common air-dried peat is not to be compared with coal as a fuel.

By various methods of manufacture, however, the crude article is very greatly improved, and brought more nearly upon an equality with coal. The principal objections to air-dried peat are its bulkiness and the considerable percentage of water which it retains. One ton of coal is said to be the equivalent in evaporative effect of eight to eighteen tons of common air-dried peat, and ordinary specimens of the latter, even when considered dry and fit to use, contain not less than 25 or 30 per cent. of water. The object of manufacture is therefore to reduce the peat in point of bulk, and to free it from water. One method adopted to compass these ends has been tried by means of a great variety of mechanical appliances by inventors on the continent of Europe, in Great Britain and even in the United States. It consists essentially in reducing the peat as taken from the bog by grinding, triturating or macerating machinery, to a pastey, pulp-like condition, after which it is spread out upon the surface of the ground, marked off into divisions of suitable size, and allowed to dry. Sometimes the peat is moulded or pressed before being dried, sometimes air-dried before being compressed, and in some methods the drying is done by artificial heat. The result, especially where the drying is hastened by artificial means, is a hard, dense fuel approaching, or equal to, coal in specific gravity and capable of emitting intense heat. The cost, however, is considerable, and though occasionally especially favorable circumstances have conspired to render the experiment feasible and to enable the manufacture to be continued, sooner or later the expense has risen to a point beyond the returns and failure has been inevitable. Peat as it exists in the bog contains 90 per cent. and upwards of water, a large proportion of which it retains with the utmost tenacity, but all, or nearly all, of which must be got rid of in process of manufacture. To evaporate eight or nine tons of water in order to obtain one ton of fuel would on the face of it seem an impracticable undertaking, hence various plans have been attempted to overcome this difficulty. One is, after the living and (for fuel purposes) worthless growth on top of the bog has been removed and the bog drained, to pass a light harrow over the surface, after which the partially dry peat is collected and the process completed. Compression of the crude peat, whether by rollers or powerful presses, has also been attempted, but in connection with the pulping process has not proven very successful, as the pulping is done with much more difficulty and requires much heavier machinery when the material is in a partially dry state. Indeed with some stiff, dense peats from the lower portions of deep bogs water has not infrequently to be added in order to effect a reduction to the necessary paste-like condition. Another system of manufacture is one in which the peat is passed through compressing machinery at the beginning of the operation, and without being pulped or having its original fibre destroyed, is dried by artificial heat and by strong pressure formed into blocks, cakes or cylinders of the desired size. The employment of artificial heat of course adds to the cost of the process, but it is doubted by some whether the water contained in the peat can be wholly expelled, or even eliminated to the required extent by pressure alone, and experience appears to bear out this view.

Peat is used not only in its ordinary form, but, like wood and coal, may be carbonized and reduced to coke or charcoal. Containing a percentage of carbon in proportion to its weight intermediate between that of wood and coal it gives on carbonization a corresponding weight of charcoal. Wood yields about 22 to 27 per cent. of charcoal, and coal 75 to 90 per cent., while peat give about 23 to 35 per cent. The condensed peat produced by the pulping process gives a much harder and denser charcoal than the ordinary air-dried article, the charcoal from which is so friable and light that it cannot be used in metallurgical operations. Peat charcoal has this advantage in common with wood charcoal over coke from coal, that it is much freer from impurities such as sulphur and phosphorus which exercise so injurious an effect in the smelting or refining of iron. These and other impurities, however, are not unknown in peat, and their absence or presence is usually dependent upon the constituents of the rocks and soil surrounding the bog from which the peat is taken. The decomposition of gypsiferous or pyritous rocks in the neighborhood of a peat bog would, for example, be sufficient to account for the presence of sulphur in the ashes of peat fuel manufactured from it. A bog in Wales containing copper pyrites was long used for the production of peat which was burned for the sake of the resulting ashes, many thousands of pounds worth of copper having been extracted therefrom. Peat usually yields more ash from a corresponding weight than wood and about the same as coal, but it varies greatly in this respect with the composition of the bog from which it is taken. Sand, lime and other similar substances are generally found in the ashes of peat, either in chemical combination or mechanical mixture, having in most cases been derived from the surrounding soil.

As might have been expected much more effort has been made to produce a good article of peat fuel economically in European countries than in the United States, where there is a comparative abundance of coal. In the latter country about twenty-five or thirty years ago coal was even higher in price than it is at present and much attention was directed to the utilization of peat, without however any lasting result. In Canada on the other hand, the fuel problem has been more pressing and at various periods processes have been in actual operation for the manufacture of peat fuel for a longer or shorter time. Recent events seem to indicate a revival of the interest in this question, for at the present moment there are three or four processes under way by which their inventors hope to solve the perplexing problem. In the neighborhood of Montreal and elsewhere in the Province of Quebec probably more persistent attempts have been made in this direction than anywhere else in Canada. Nearly thirty years ago Hodges placed his pulping machinery on a scow and manufactured peat at Bulstrode, at we are informed, a cost of 92 cents per ton, and large quantities were consumed as fuel for the locomotive engines of the Grand Trunk Railway. A somewhat similar process invented by N. Aubin and improved by Hally was at work for a time under the management of the Valleyfield Peat Company, while Aikman of Montreal for many years has been experimenting and is still experimenting, with the process of manufacture which bears his name. Mr. Dickson of the same city has invented a process somewhat different in principle from any of these which he believes is now perfected and which the company he has formed intend to have in operation this coming summer in a bog on the Welland Canal where they have purchased a tract 3,000 acres in extent. I have here specimens of Aikman's, Hally's and Dickson's peat fuels, as well as samples taken by myself from a small bog near Berlin, Ontario. The last named sample is of the ordinary air-dried kind and being taken from the bottom of the bog, shows the deposit of shell marl underlying the bed of peat. Specimens of Aikman's and Dickson's manufacture—corresponding to these have been submitted to Prof. Ellis of the School of Practical Science, Toronto, for examination. He has tested them in a Thompson calorimeter with the following result :—

	Aikman Peat.	Dickson Peat.
Moisture	7·4	10·2
Ash	19·5	2·9
Heating power	5115 units	5280 units

Three samples of standard kinds of bituminous coal were also submitted to Prof. Ellis for purposes of comparison, which gave in heating power as follows :—

	Units.
Hocking coal, Ohio	6,820
Massilon coal, Ohio	7,425
Reynoldsville coal, Penn	7,480
Mean	7,241

The heating power is expressed in metric heat units.

It will be seen that the two specimens of peat are nearly alike in heating power, and that in this respect they stand respectively in the relation of 71 and 73 per cent. of the mean value of the samples of coal. The average price of Reynoldsville coal at Toronto, where it is said to have control of the market for heating purposes, is $4.25 per ton, so that on the basis of calorific value alone these peats would appear to be worth about $3.00 or $3.10 per ton. The percentage of moisture does not materially differ in the two samples, being 7.4 and 10.2 respectively, and it is probable that experience would show the inutility of going to the trouble and expense of reducing the contained water below the smaller of these figures, as on exposure to the atmosphere the absorbent qualities of the peat would doubtless be sufficient to restore the percentage of water to at least this point. The greatest difference between the samples is in the matter of ash, in respect of which there is a marked inequality, one sample showing 19.5, and the other 2.9 per cent. This is of course due entirely to the composition of the bogs from which the samples were made, and has no bearing upon the merits of the processes of manufacture themselves. If the crude peat contains a considerable proportion of incombustible matter, no amount of trituration, compression, or other subsequent treatment will lessen it, and the plain inference is that in the manufacture of peat fuel, only those bogs should be employed which careful experiment shows to be reasonably free from inorganic substances. The proportion of ash contained in the more impure of the two samples, 19.5, is so high as to seriously detract from its value as fuel, and would lead to the conclusion that the bog from which it was made is not well suited for the manufacture of the article.

A recent letter from England gives an account of a process by which Mr. J. D. Brunton of London, is attempting to utilize the peat of Dartmoor, in the production of pig iron from hematite ore, of which abundant supplies exist in that district. He proposes to use, by a happy reciprocity, the waste gases from the blast furnaces to dry the peat, and the peat, apparently without being charred, to smelt the iron. It is estimated that 200 tons of peat will suffice for a yield of 100 tons of pig iron per week. The cost of iron ore is put at from 3s. to 6s. 6d. per ton, and the cost of the pig iron made under these conditions after ample allowance for contingencies, at £2 15s. per ton. If the selling price of the iron be put at only £5 per ton (a low price for charcoal iron) a profit of £2 5s. is expected to be realized. A square mile of the Dartmoor peat ground, is said to be sufficient to supply fuel for a make of 100 tons of pig iron per week, for 100 years. The application of the hot gaseous products of blast and other furnaces to the dessication of peat is not, however, original with Mr. Brunton. On the continent of Europe, kilns for drying peat have been constructed in which the hot waste gas of furnaces is driven through the roof by means of a fan, made to descend through the peat, and thence pass into a chimney communicating with the interior of the kiln at the bottom by two flues, one on each side. Kilns on this principle are said to have been first introduced by Schlagel, into Austrian smelting works, and extensively adopted especially in French smelting works. The distinguished Swedish iron master, Gustaf Ekman, in 1856 erected a peat kiln upon this principle with, it is reported, an entirely favorable result. Ekman heated his kiln with the waste gas of a charcoal finery, which gas after having been used for heating pig iron, the blast of the finery, and an annealing furnace, was admitted into the kiln. Kilns constructed on the principle of taking in the hot gas at the top, are said to dry the peat more equally and quickly than those in which the gas enters at the bottom. Peat, and peat charcoal are used to some extent in the smelting and refining of iron in European countries, but where, as in Great Britain, mineral coal and coke are abundant, the latter are more generally employed. Dr. Percy, after a somewhat extensive review of the subject in his work on fuel, gives it as his opinion that "by a judicious selection of peat and suitable treatment, peat charcoal might, so far as relates to its capability of producing peat, serve as an efficient fuel for metallurgical operations." He adds that "the use of peat charcoal for fuel must in great measure depend upon the cost of its production, inclusive of the cost of the original peat, and its capability of competing in that respect with other fuel, namely, wood charcoal, certain kinds of coal and coke."

The widest field of usefulness for peat in metallurgical processes would appear to be as material for the production of gas for use in the so-called regenerative furnace invented by the brothers Siemens, which has come so largely into use for smelting and refining purposes. To quote Percy again: "Experience on the continent has conclusively shown that peat-charcoal may be used in some metallurgical operations with success; also that peat may be successfully used for the production of gaseous fuel in a gas producer. Mr. C. W. Siemens, indeed, has informed me that putting its cost aside he should even prefer peat to coal for use in the producers of the regenerative gas-furnace. Now, the metallurgical operations to which gaseous fuel has been applied are already numerous and it seems capable of even much wider application. The drawback in the employment of peat when high temperatures are required, resulting from its containing a large quantity of water, is obviated by converting it into gaseous fuel and subsequently condensing the moisture contained in the latter. So far, therefore, as the suitablity of peat for metallurgical purposes is concerned, we may not unreasonably conclude that it could be widely substituted for coal with success." Percy goes on to state his conviction that peat can only compete with coal in countries where the cost of production and carriage of peat is relatively very low, and the price of coal very high, and that as regards Great Britain, circumstances must greatly change before these favorable conditions for utilizing peat are fulfilled. Percy's conviction as regards Great Britain is doubtless well founded, but the state of things in Ontario and Quebec is vastly different from that in the mother land. The pregnant fact that while there is abundance of coal in England, there is none at all here, changes the situation entirely, and conclusions which may be justly arrived at in the case of Great Britain are altogether inapplicable in our own. The cost of carriage which in England would be greater upon peat than coal is here decidedly in favor of peat. Our only supplies of coal lying either a long way to the south in another country, or a long way to the east in another province, the item of freight charges must always be a heavy one, and must continue to add largely to the cost of the coal used here, while on the other hand once a really practical and economical system of manufacture was introduced, the peat bogs which are found in all quarters of Ontario and Quebec might be sources of fuel supply to surrounding districts at a minimum cost so far as freight charges are concerned.

There are very large areas of peat in Ontario. Mr. E. B. Borron who has penetrated through the wastes of the Hudson Bay slope tells us that in his opinion there are 10,000 square miles overlaid with peat from six to twenty feet in depth in that part of the Province. In the district between the Ottawa and the St. Lawrence rivers, in the vicinity of Lake St. Clair, in Elgin county, in the Parry Sound district, in Waterloo county, in Welland county, along Welland Canal, in the counties of York and Simcoe, along the line of the C.P.R., west of Lake Nipissing, and in many other sections of the Province are peat bogs of large area, and were they to become valuable as a result of a perfected process of manufacturing peat fuel the existence of many others would no doubt be revealed.

Peat fuel has been successfully employed for all the purposes for which coal and wood can be used. For some of these purposes it is owing to its bulk, less adapted than coal, as for instance in steamer and locomotive boilers, where economy of space is a great object, while for others, as we have seen, it is a very efficient substitute. Even in the production of illuminating gas it has been employed with good results, as for example in Dartmoor, England, where the prison at Prince Town is or was lighted with gas made from peat.

In conclusion I have only to express my conviction that this problem of the utilization of peat for fuel is one of the most important and pressing of the economic questions which are to-day engaging the attention of the people of Ontario and Quebec. Though the difficulties which lie in the way of its solution have proven themselves to be many and formidable, the ingenuity of man I am convinced is equal to the task of overcoming them. I cannot think that the quest after a good and cheap peat fuel is the chase of an *ignis fatuus*, but on the contrary I cherish the hope that ere long we shall see a process in successful operation which will utilize our own resources, give us a first-class fuel at a cost below that of coal, and deliver us from the yoke of a foreign monopoly.

THE PEAT RESOURCES OF CANADA.

By R. W. Ells, LL.D., Ottawa.

The importance of the peat deposits which are found in all the provinces of Canada has long been recognized, and a number of attempts have been made from time to time to turn them to profitable account. Some of these have for a brief period given fairly satisfactory results, but all have, owing to various causes, gradually been abandoned. At present, however, there appears to be a growing interests in the question of their utilization, and it is to be hoped that, profiting by the mistakes and experience of the pioneers in the industry, some more practical scheme than has yet been in operation may be devised, so that the manufacture of peat, either for fuel or other purposes, may be placed on a paying basis.

This industry has a more important bearing upon the provinces of Ontario and Quebec from the fact that, while the inhabitants are there largely engaged in manufacturing pursuits, requiring a large supply of fuel, it has long been a settled question that in neither of these provinces can any natural supply of coal be expected. In Ontario this lack of coal for fuel may be, to a certain extent, met by the use of crude petroleum, burned in properly constructed grates, and the experiments already instituted in that direction have shown that, for heating and the generation of steam, this substance possesses very many admirable qualities. In Quebec, however, this source of supply appears to be unavailable, in so far at least as the researches in the Gaspe district, which may be regarded as our only oil field, have proceeded. Natural gas has also of late years entered the field as a possible competitor in the matter of fuel, more particularly in the province of Ontario, though wells giving a limited flow of gas have also been bored at different points in the St. Lawrence area east and north of Montreal. This source of supply, however, does not meet the requirements of the case as satisfactorily as could be desired, owing doubtless, to some extent, to uncertainty as to its persistence, and also to the fact that it is unsuited to many purposes requiring a solid fuel. The fact also that the nearest available sources of coal fuel in eastern Canada are situated in the province of Nova Scotia, the nearest of which to Montreal is about 700 miles by rail, while the great areas of Pictou and and Cape Breton are still more remote, must also be carefully considered in the discussion of such a question as the utilization of the peat deposits near home. True it is that the adjacent province of New Brunswick has a very considerable development of carboniferous rocks, and has by many been quoted as a great source of future supply of mineral fuel, but from a careful examination of that country it must be remarked that, owing to the thinness of the coal seams, rarely more than twenty to twenty-two inches, and the peculiar soft character of the coal itself, which unfits it for much handling, as also for other purposes for which a good coal is now required, the utilization of this fuel must be, to a very large extent, merely local. The other remaining sources of supply, more especially for Quebec, are the distant coal-fields of the British Islands, from which, during a certain portion of the year, fuel can be cheaply brought owing to a low rate of freight, so cheaply, in fact, as to enter into close competition with the output from the Nova Scotia mines, and the deposits in the United States from which, owing also to canal transportation, fuel can be laid down at certain seasons almost as cheaply as from the lower provinces. Still the fact remains that freight rates both from Nova Scotia and the Pennsylvania fields are such as to make the price of coal fuel laid down in the manufacturing centres of Ontario and Quebec so high that many of the manufacturing and mining industries in both these provinces are seriously hampered, through the comparatively great expense involved in keeping our steam engines in motion and thus providing the power necessary to successfully carry on the various industries of the country.

The value of the peat deposits must, however, after all be merely a comparative one. If it can be conclusively shown that a peat fuel can be produced, possessing let us say 100 heat units, and placed in the markets of Ontario and Quebec, at a well defined less rate as regards cost than 100 heat units of coal, taking the coals of Nova Scotia and the United States in ordinary use as the standard, then it should be apparent that our peat deposits are worthy of attention as an important factor among the manufacturing, or power producing agents of the day, To do this, however, we must first of all consider several important features of the industry, such as the extent of our peat deposits, the calorific power of well prepared peat fuel, the convenience of handling and the advantages it possesses, if any, over the fuel at present at our disposal, and in addition to this, and this is an especially important item, the cost of its manufacture.

In the utiltzation of our peat bogs we must, however, bear in mind that other phases of the question possess an equal if not even a greater present economical value than that of fuel supply. For instance the question of the application of peat to sanitary purposes, for the reception and economic disposition of the sewage of large cities, is now being considered, and it has been ascertained that in this respect no substance yet known possesses presumably greater or more valuable properties in this direction than this produce of our peat bogs, so long regarded as practically valueless. Further, a comparatively new industry has come into prominence in connection with these deposits, which in Holland and elsewhere, has already reached a very extensive development and which should also furnish handsome returns on capital in the country, viz., the manufacture of moss litter. This material from its great absorbent properties has been found to surpass all other substances in the utilization of stable waste, and for promoting the comfort and cleanliness, and as a consequence the health of all animals there kept. So great is the importance of this industry, as yet comparatively unknown in Canada, that the peat bogs of Holland are now supplying the markets of London and New York, with this prepared moss litter, with a demand apparently unlimited and at a price quoted on the London market of 21 to 26 shillings per ton, according to quality, which should furnish highly remunerative results.

In the report of the Geological Survey for 1845-46, attention was directed to the Canadian peat deposits, and the results of the investigations on this subject by Dr. T. Sterry Hunt appeared in subsequent reports. Among those of special importance are the articles in the Geology of Canada, 1863, and in the report for 1866. In the pamphlet prepared for the Paris Exhibition, 1878, further information is presented more particularly relating to the trials carried on in the deposits east of St. John's in connection with the Hodge process, and at St. Hubert, in the county of Chambly, at which places very extensive bogs of excellent peat occur. A very considerable quantity of prepared fuel was produced at these places aggregating in 1875 about 13,000 tons in all, a small amount being used for domestic purposes, while the rest was employed by the Grand Trunk Railway for their locomotives. Changes in the company, however, appear to have acted unfavorably as to the continuance of the industry, and since that date but little has been done in this direction. A small quantity of prepared peat was also produced about the same time near Port Lewis, in the county of Huntingdon, as well as Newtonville, near Port Hope, in Ontario. Unfortunately no reliable data as to the cost of manufacture at either of these places is at hand and no subsequent developments appear to have taken place.

While the peat deposits of Quebec and Ontario are known to be very extensive, the greater part of these have hitherto remained untried. Among the best known may be mentioned for the latter province, the vicinity of the Caledonia Springs, lying to the south of the Ottawa, in the township of Caledonia, county of Prescott, and certain bogs in Clarence, Cumberland and Gloucester, the latter in the county of Carleton. Of these, that nearest the city of Ottawa is the Mer Bleue, which consists of two long peat bogs, separated by a narrow ridge of higher land, and comprising in the two an area of not far from 5,000 acres. These bogs were sounded by Mr. James Richardson of the Geological Survey staff, and shewn to have a depth in places of over twenty feet, the depth elsewhere ranging from five to fifteen feet. Three other large areas from 1,000 to 3,000 acres each occur in the townships of Nepean and Goulbourn adjoining, while other large extensive bogs occur in Huntley and Westmeath. The depth of peat in these deposits varies from eight to over fifteen feet. Further south in the direction of Cornwall, bogs are found in Osnabruck, Roxburgh and Finch, so that it is easily seen that a practically inexhaustible supply of the material is found in the almost immediate vicinity of the Ottawa and St. Lawrence and in close proximity to the leading manufacturing centres. In Western Ontario also peat bogs have been noted at many points, as in the vicinity of the Welland Canal and in the western portion near to the St. Clair river, as also in the counties of Simcoe and York, and further west along the line of the Canadian Pacific Railway, north of Lake Superior, as well as on the route between that lake and Winnipeg.

Inexhaustible supplies also occur in the province of Quebec, as in Chambly, at St. Hubert and at St. Brigide, where works have already been in operation. On the line of railway from Arthabaska to the St. Lawrence opposite Three Rivers, at Bulstrode, a bog was also formerly worked quite extensively, the product as air-dried peat being used on the Grand Trunk Railway; as also in Huntingdon, Champlain, Lacolle and Sherrington, where a very thick deposit of excellent peat, particularly worthy of notice is found. East of Valleyfield also and in St. Dominique extensive deposits occur; while on the north side of the St. Lawrence they are known in the townships of Grenville, Harrington, Mille Isles, Ste. Anne des Plaines, St. Sulpice and Lavaltrie and St. Maurice. On the lower St. Lawrence peat bogs are found at River Ouelle, Isle Verte, Daquam, Matane, Macnider and other places, while on the Island of Anticosti an immense bog, estimated at nearly 200 square miles in extent, occurs on the south-west coast, much of which is reported of excellent quality. From this brief enumeration of a few localities it is easily seen that the quantity of this possible fuel in Quebec is also practically unlimited.

Peat bogs are all of vegetable growth, consisting for the most part of the decomposed remains of plants and mosses chiefly of the genus sphagnum, which has apparently filled up the basins of shallow lakes. The deposits are frequently underlaid by a layer of shell marl which has constituted the original lake bottom. The peat bog frequently carries a growth of trees, often of tamarac in a stunted condition, with various heath plants, which by the decay, both of their stems and rootlets, help to swell the organic constituents of the mass. In bogs of a good depth the peat may be divided into three classes, viz., 1st, the green living and growing surface, 2nd, the intermediate zone in which the remains of the plants are well defined but which is capable of furnishing an excellent peat for certain purposes, and 3rd, the lower and fully digested material in which traces of organic life are comparatively rare, which possesses a rich black or brown color and when free from inorganic matter, furnishes a fuel of very excellent quality.

In character also peat varies somewhat owing to the nature of the underlying rocks. Thus moss peats are generally found on rocks nearly free from lime such as granite or other strata rich in silica, while grassy or sedgy peats are more frequently found in calcareous districts. In the ripest or most thoroughly formed peat, the decomposition of the organic matter has reached the last stage, the result being a dark brown or black homogeneous mass, comparatively heavy and dense. This when moist is firm, sticky and coherent like clay, and can be readily cut and moulded into any shape, and when dried it is hard having on cut or burnished surfaces a lustre like pitch or wax.

In the development or exploitation of a peat bog for fuel it would apparently be advisable to make use of that portion which is freest from organic remains, viz., that which occupies the lowest of the third strata just described; and in former experiments upon the large scale possibly it may be found that some of the lack of success that attended these efforts was due to the attempt to utilize an inferior portion rather than that most adapted to the manufacture of the best fuel. In this connection it may be wise to consider also that it is possible now to utilize the upper portion of the bog as well, in the preparation of the moss litter, though the only attempt to develop this industry in Canada, in so far as I can yet learn has been in New Brunswick where several years ago operations were begun in a peat bog about fifteen miles west of St. John at a place named Musquash. The promoters were capitalists from St. John and St. Stephen, and a brief account of their operations will be found in the Report of the Geological Survey, 1889, by Mr. R. Chalmers. No attempt, however, was made to manufacture a peat fuel owing presumably to the facilities possessed at this place for obtaining bituminous coal from the adjoining province of Nova Scotia, the freight from the mines of Cumberland county being low. In order to show, however, what has been attempted in this direction, I may here quote a brief extract from the report just referred to. "This article, 'moss litter,' is used in stables as bedding for horses, &c., and owners of studs in the principal cities of the United States have been looking for a material of this kind prepared from the peat found on this side of the Atlantic. What they require is a spongy moss, sufficiently light and porous to be an absorbent of the liquids and ammonia which collect in stables, and which after being used in this way would make a fertilizer for gardens, &c. The company having purchased the bog at Musquash, are now, 1889, erecting buildings and machinery there for the preparation of the article. They claim that the peat moss found in this locality is well adapted for the purpose intended, and is equally as good as the German moss litter. Hitherto a large amount of time and capital has been spent by the Musquash Co. in experimenting and testing the suit-ability of the different grades of peat or boggy material obtained here for the purpose in view, and it has been found that what is about half decayed, *i.e.*, sufficiently so to be changed to a dark color and rendered somewhat short in the fibre, without being absolutely brittle, is the best. This kind of peat is not found in the upper or living part, not yet in the deep lying rotted material, but between the two, where the mosses and rootlets are partially decomposed and the fibres strong enough to prevent the moss from crumbling to pieces. The chief process in its preparation is that of depriving it of the water, of which it contains from ninety to ninety-five per cent. This is effected partially in the pit by a machine called a plunger. The moss is then brought by tramways into a building and subjected to great pressure by passing between heavy rollers, and lastly the residual moisture is driven off by evaporation, after which it is packed into bales for shipment."

In the attempt to manufacture a compressed peat fuel of the first quality, or even an air-dried product, it would be well therefore to take into careful consideration the question of utilizing this second layer of say four to five feet for the purpose just mentioned, since it should, if properly managed, prove equally a source of profit as the manufacture of the fuel itself, while it would enable that portion of the bog best adapted for the latter purpose to be more readily and economically operated.

Two great drawbacks have hitherto been found in regard to the utilization of peat as fuel on the commercial scale, viz., the great bulk of the air-dried variety, thus requiring great storage facilities, as well as excessive charges for transport, and the contained water, which even in the best air-dried qualities reaches 18 to 20 per cent. This contained water must of course greatly diminish the calorific value of the fuel, and it is the practical impossibility hitherto experienced of reducing this great percentage of contained moisture without very considerable expense which has apparently interfered with the successful economic use of the fuel in our manufactories and locomotives.

In the matter of contained water air-dried peat ranks on a par with the best qualities of air-dried wood but possesses this disadvantage that it contains a much greater quantity of ash, and also has a marked tendency to absorb moisture very readily, a feature which is apparently very difficult to guard against. In the digging of peat also the precaution must be taken to provide against the action of frost, since if frozen when wet its coherence is destroyed and it becomes useless as an air-dried fuel.

It is evident from a careful examination of the tests already made of our peat deposits that the objections already mentioned in regard to the air-dried product practically exclude it from the market unless for purely local consumption, and the future course of the industry as regards the fuel question must be along the lines of producing cheaply a thoroughly good compressed article. In this connection, due care must first of all, as already suggested, be paid to the quality of the raw material used. For while simple pressure will reduce the peat to a much smaller bulk, if the material is originally light and porous, its natural elasticity will tend when once the pressure is removed to restore it to its normal condition. It has also been found in practice hitherto that the machines employed, no doubt in some cases owing to a lack of proper preparations of the raw material before subjecting it to pressure, have failed to thoroughly remove the contained water; and this has, of necessity, if a drier article is required, to be removed by the application of artificial heat at a considerably increased expense, the value of the fuel however being found to be greatly increased by this action. As regards the specific gravity of the peat this depends principally upon its position in the bog, and when uncompressed ranges from .25 to .9. In deep bogs a first-class peat of dark blackish or brown color and earthy fractures should have a gravity of .6 to .65. In carbon contents it ranges from 51 to 63 per cent. of the organic matter, its quality being due to its density and ripeness. From a series of experiments conducted by Prof. Johnson of the Yale Scientific School, it would appear that, weight for weight, the ordinary qualities of peat do not differ very greatly from wood for heating purposes. By compression its heating properties are very greatly increased. Thus it was found that while a good peat, cut and air-dried, had a heating value of .80, the same condensed and containing ten per cent. of water had a value of 1.48, and made into peat charcoal the value was increased to 1.73. Compared with wood this value was found to range from .50 for poplar to 1.18 for summer oak.

As compared with anthracite tests made by the Water Department of Brooklyn showed the ratio of peat to this fuel to be as 1 to 2.25 and a table prepared by Prof. Johnson, showing the comparative composition and quality of peat, wood and anthracite is as follows :—

	Carbon.	hyd.	ox. and nit.	ash.	water.	sp. grav.
Wood.....	39·6	4·8	34·8	0·8	20	·75
C. peat.....	47·2	4·9	22·9	5·	20	1·20
Anth......	91·3	2·9	2·8	3·	..	1·40

In regard to the manufacture of coke from peat it may be remarked that its value has been known for many years. Thus we learn that as early as 1727, patents were issued in England for the smelting and manufacture of iron with this fuel, and in the Hartz Mountains in Germany peat charcoal was used in metallurgical operations on a large scale in 1735, but it is stated that owing to the novelty of the process and through the agency of certain parties interested in keeping up the price of wood, its use for this purpose was discouraged. Coke from simply air-dried peat is found to be too tender for use in the blast furnace, but that from compressed peat was regarded as equally as good for this purpose as that from bituminous coal. The results of its use in the blast furnace are, however, conflicting as regards its value, this probably being due to differences in the quality of the coke employed. From a number of trials made in Ireland it was held that the quality of peat coke was equal to that of gas coke while the total cost according to Vignole's process, in which the carbonization was effected by means of super-heated steam, was about two dollars per ton (8s. 4d.), with the price of raw peat at four shillings. Three tons of peat were required to produce a ton of coke, the expense being reduced very considerably by the utilization of the by-products such as wax, tar, gas, &c.

Probably in no country has the manufacture of peat fuel and charcoal been more successfully carried on than in France, and in the earlier reports of the Survey some valuable information will be found as the result of the study of the industry by Dr. T. Sterry Hunt at the time of the French Exhibition in 1855. Among those who have brought the industry to a high pitch of perfection may be mentioned Mons. Brughat, and a few extracts from a short pamphlet of his on the subject may here be given. After summing up the various analyses of peat, wood, coal and charcoal, he says that the calorific power of compressed peat made according to the Challeton process as compared with wood and coal is in round numbers as follows :

Compressed peat varying in value according to the process of manufacture and containing 10 per cent. of water from	3 to 4
Peat charcoal	4½ to 5
Bituminous coal, 1st quality	5
Anthracite	9½
Wood charcoal	1 to 1¾
Wood, containing 25 per cent. water	¾ to 1½

In a special report by Dr. Harrington, of McGill University, prepared in 1871 in connection with the peat deposits of the province of Prince Edward Island, assays were made of several of the peat fuels obtained from the bogs east of Montreal. The samples are from air-dried material and the assays are as follows:

	1	2	Mean.
Water (hygroscopic)	14·82	15·10	14·96
Volatile combustible matter	60·10	59·10	59·60
Fixed carbon	21·80	22·60	22·20
Ash	3·28	3·20	3·24

The assays of two samples of Hodges peat which had been kept within doors for a year, are also given:

	1	2	Mean.
Hygroscopic water	16·80	17·32	17·06
Volatile combustible matter	49·80	51·65	50·725
Fixed carbon	26·90	25·00	25·95
Ash	6·50	6·03	6·265

The excellent paper published in the last bulletin of the Bureau of Mines, Ontario, on the subject of peat, sums up very concisely most of the information contained in the several government reports, and supplements this with a great variety of facts bearing on the general aspect of the question. From this it would appear that the recent tests with locomotives and stationary boilers did not give as good results as were anticipated, the percentage of power to cost being very considerably lower than that obtained either from the use of bituminous coal or even wood. This would show conclusively that the quality of the peat employed was far from being what it should be, judging from the table just quoted, containing presumably an excess of water, greater even than should be found in a first-class air-dried peat. It is possible this peat was obtained from a portion of the bog not representing the best qualty for fuel purposes, and thus shows that in the attempt to place this industry in a thoroughly satisfactory commercial basis great care must be exercised in the selection of the raw material. As Brughat has pointed out, repeated failures attended the attempts in this direction for some years both in France and Germany, and it has been only by a careful study of all the conditions, not only as regards the material itself, but the methods of manufacture, that he claims the success which he has at last attained. It seems difficult to realize the statements as to profit given by Brughat as stated in the bulletin of the Ontario Bureau. But the claim he makes that one and a quarter tons of peat coal are equal to one ton of the best English coal for ordinary steam purposes, and for domestic purposes under proper conditions of draft and grate construction the value is equal ton for ton, deserves a careful consideration of the methods of which these results may be attained by those interested in the furtherance of this industry in Canada. With coal selling at $3.50 to $6.00 per ton, which may fairly be assumed as the price paid in Quebec and Ontario, in many places for even Nova Scotia slack for boiler use, a compressed peat capable of production at half that price should be profitably employed; while for house purposes where the price of bituminous coal reaches $6.00 and even in Ottawa $8.00 per ton, a first-class peat fuel should return very handsome profit to the producer. The great extent and apparent value of the peat deposits in this country, together with the very large present consumption of coal and the high prices paid therefor, would appear to warrant the most exhaustive series of experiments tending to solve satisfactorily the economic aspect of the question, not only in the production of a fuel suitable in every way for domestic and steam purposes, but for employment also in the reduction of our iron ores and for the various other processes concerned in the manufacture of iron and steel. In this connection we may be permitted to quote again from Brughat: "It is especially in metallurgical works that very great economy results from the use of our peat. We will attain among other things, both iron and steel of better quality, than by the employment of either coal or coke, since the coke therefrom contains no sulphur as has been proved by numerous analyses made with the greatest care, as well as by practical tests conducted in our forges and blast furnaces, both in the manufacture of cast steel, cutlery, gun-barrels and in the casting of the metals.

In a paper by Prof. N. S. Shaler of Harvard University, published in the tenth annual report of the U. S. Geological Survey, on certain fresh water deposits in that country, he remarks on the subject of peat, that in his opinion a good peat fuel could be produced at a cost of $5.00 per ton with labor at $1.50 per day. In view of the results already obtained in the attempts to work the Canadian deposits, as quoted in the Geology of Canada, 1863, and from statements as to cost contained in Brughat's treatise, as well as those obtained from the manufacturers of this fuel in Ireland, we believe that a first-class article can be produced in Canada at a much less figure than he states. Such results, however, will only be obtained by avoiding the mistakes already so often made by those who have attempted the solution of the problem, and by paying due attention to the quality of material employed as well as to the use of the best appliances for compressing and preparing for market a fuel containing the least possible percentage of ash and moisture, and in this way obtaining results which will place this material more nearly on a par as regards effectiveness with our best quality of bituminous coals.

DISCUSSION.

Mr. DICKSON—I have very little to add to what has already been said except to say that I have a company organized in Toronto and we have purchased the Welland bog, and are getting machinery to turn it out on a large scale. These here are simply samples. It is the intention to turn it out in large blocks about three inches in diameter for steam generating purposes, and about two inches for domestic purposes. We find by experiment that we can make fuel for $1.50 a ton. The moisture is driven off entirely by pressure, and reduced to about 10 per cent. We find the upper portion, that is after the moss had been removed, nearly as good fuel as the lower portion; and those samples there are made from the upper entirely.

The Welland Canal runs through the bog which we intend operating during the coming season, which affords excellent facilities for shipping; and besides that there are several railways adjacent. It is the intention of the company when started to start other similar operations in the Province of Quebec where it is expected it can be manufactured for $1.50 a ton.

Mr. Bell—What do you think you can put it on the market for?

Mr. Dickson—Oh, well less than coal.

Mr. Doucet—I would like to ask if this sample has been subjected to water.

Mr. Dickson—Yes.

Mr. Doucet—What was your experience?

Mr. Dickson—It is proof against all ordinary moisture, but if soaked will absorb a certain percentage. It has been soaked for several hours, but after being soaked for 24 hours it has absorbed about 20 per cent. of water.

Mr. Doucet—It this pressed by heat?

Mr. Dickson—No; perfectly cold.

Mr. Doucet—Where does this peat come from?

Mr. Dickson—That is Quebec peat, from the Champlain bog. I have several specimens from Welland and Berlin. Here is a sample we pressed and which makes nice fuel.

Mr. Gibson—That Hally peat has not been pressed. It is simple pulp peat dried by evaporation.

Mr. Doucet—Has this ever been burned?

Mr. Dickson—I don't remember the analysis; but I think less than 3 per cent., 2.09 per cent. I think, was ash. It is not pressed by hydraulic pressure.

Mr. Bell—I would suggest that Mr. Dickson at some future time should give us some details of his process.

Mr. Dickson—If I had had longer notice I would have been glad to do so to-day.

Prof. Harrington—I have been interested in this subject. I have had some little experience a good many years ago with it, and quite agree with most of what has been said. I think there is no reason why we should not utilize peat in various parts of the country.

A NEW SECTIONAL BOILER FOR PROSPECTING PURPOSES

By Hector McRae, Ottawa.

Owing to the difficulties and expense in the transportation of steam boilers into a mountainous mining camp, Mr. James Kelly, Ottawa, recently hit upon a scheme for the construction of a sectional boiler that could be packed without trouble over mountain trails. The first boiler on this principle was made in Ottawa in December last; and six weeks after the order was given to the manufacturer was working on the Wellington Mine, in the Kootenay district, B.C. The sections were packed in strong cases of about 500 lbs. each, and were undisturbed till they reached end of wagon trail, about 2½ miles from the mine, where the cases were opened up, and the boiler packed in on ten mules.

The mule trail was cut through 9 feet of snow the full distance 2½ miles. The mine is at an elevation of about 3,500 feet, and the actual cost of transporting the boiler up the trail was less than $50.

An outfit consisting of section 10 h.p. boiler, mining pump, diamond drill, tools, rods, &c., was packed in and commenced work inside of 2½ days from time of arrival at end of wagon trail. The boiler is simply constructed. The shell plates are bolted together instead of being riveted; the heads of the bolts are inside the shell, and before the nuts are put on are wound tightly around with gasket; iron washers are then placed next to the shell and the nuts screwed up tightly.

The crown sheet at the fire end is countersunk, through which the tubes are inserted, and the tubes at this end are flanged. At the other end they are threaded; washers are then placed on them, and after being gasketed thoroughly are drawn tightly into place by buckles. Three perforated tubes are placed in the interior of the boiler, in the inside of which run three tubes; this is done to keep the crown sheets in place. The smoke stack is also put together in same manner as shell of boiler, with short bolts and nuts, and the links go over each other like an ordinary stovepipe. Instead of the heavy cast iron grate bars, one inch round iron rods, about two inches apart, are passed through the fire box, and are held in place by nuts, with washers bevelled to fit the curves of the box. It is not claimed that the wrought iron bars will last as long as the cast, but as wood fuel is generally used, the wrought iron bars suit the purpose very well, and being about one-sixth the weight of cast iron bars are more convenient to handle, and can be easily removed at a slight cost.

The total weight of a 10 h. p. boiler is 2,000 lbs., made up as follows:—

4 shell plates, 160 lbs. each	640
2 plates, fire box	320
2 crown sheets	280
Grate bars	60
Extra grate bars	40
Tubes	600
Bolts, nuts, &c	60
	2,000

Weight of cases, about 200 lbs.

Boilers of any required capacity can be made on this principle.

THE FUTURE OF THE MINING INDUSTRY IN THE PROVINCE OF QUEBEC.

By J. Obalski, Inspector of Mines for the Province.

The Province of Quebec has an area of 188,688 square miles, which will no doubt shortly be augmented by the territory between our present northern boundary and Hudson's Bay, same comprising 116,539 square miles; the population at present is say one million and a half.

Of this large area about 40,000 square miles only have been settled upon (and although of course a considerable amount has been inspected for timber), there remains an immense area comparatively unexplored. A glance at the map of the Province will indicate more clearly than words can the relatively small proportion of surveyed and settled territory.

It may be said that the mining industry in this Province forty years ago was *nil*; the only operations then carried on being the production of iron in the St. Maurice district on a small scale. It soon became known, however, that minerals existed; the discovery of gold was quickly followed up by that of copper, and subsequently phosphate, asbestos, mica and several other minerals or ores of minor importance. The history of these is similar to the discovery of minerals in other parts of the world, viz: the populace is excited, a boom and speculation result, high prices are obtained, followed by a depression, after which matters come down to a business footing, and a steady volume of trade at remunerative prices is established. The capital interested in this Province is principally English and American, and it is apparent that every facility should be afforded foreign capital to come into the country, and thus hasten the development of our minerals. The present product of the mines is largely shipped to Great Britain, Europe and the United States, who in many instances impose a duty on same, for example, 75c. per ton on iron and copper ore going to the United States, and 25% on manufactured asbestos goods, etc.; we are also obliged in some instances to import machinery, so that when the circumstances are fully considered we need not be surprised that our Province does not advance more rapidly than is the case at present. We have made considerable progress, nevertheless, which can be seen by a comparison between the state of this industry in 1880 and that of the past year, 1892, as given below:

1880.

The Beauce gold fields idle owing to legal complications.

Copper ore at Capelton operated by two concerns, shipping ore and matte.

Phosphate in Ottawa district opened up, about 8,000 tons shipped.

Asbestos worked in Eastern Townships and a few hundred tons shipped.

Iron ore blast furnaces at Radnor and Drummondville using a few thousand tons of ore.

Building material operated on about same scale as at present.

Little or nothing done in other minerals.

1892.

Gold—The legal question disappeared and work resumed on alluvial deposits in Beauce and Compton. The quartz veins are prospected and result is encouraging.

Copper—Worked by three large concerns; 57,641 tons extracted, and 53,413 shipped to the United States. A factory has been erected which produces sulphuric acid and artificial manure, the latter used in connection with the Ottawa phosphates.

Phosphate—The maximum output since 1880 was 26,000 tons in 1885, but owing to depressions in prices at present the output is only about 11,000 tons.*

Asbestos—The shipments in 1890-91 exceeded 7,000 tons each year, but in 1892, owing to difficulties between producers and consumers, and a depression in prices, the quantity shipped is much less.

Iron Ore—A modern furnace was erected at Radnor and 26,540 tons of bog ore were used in this place and Drummondville. A quantity of 8,700 tons of magnetic ore was shipped to the U. S.

Lead—Important work has been done at Lake Temiscamingue, but operations are suspended at present.

Mica—Large operations are being carried on in the Ottawa district, the product being chiefly amber mica. In the Saguenay region white mica is found in abundance.†

Ochre—Two important concerns are now working in the vicinity of Three Rivers, and their output is steadily increasing.

Petroleum—Numerous borings have been made in the Gaspé District, and oil has been struck in small quantity. A considerable amount of money was invested in careful prospecting, and better results are anticipated in the future.

Building Material—Slate granite and limestone are worked on a large scale, and I would draw attention to the granites and marbles of the Laurentain formation.

By comparison of the two periods, we can now see the progress which has been made, and which under certain circumstances might have been greater.

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* NOTE—I consider the present depression only a temporary one, and that there is a fnture for our apatite on account of the sustained high grade of same, viz:—80% and, upwards, and which in reality constitutes a different class of phosphate, and is not a common article.

† NOTE—The employment of mica in constructing dynamos and other electrical appliances, has created quite a market for this product, and as same is likely to increase rather than diminish, it would appear that there is a brilliant future in store for this indurstry.

I cannot speak with great exactitude regarding the amount of capital invested in mining operations in the province, but roughly speaking it would be about eight millions of dollars, and the value of plant, etc., very near one and a half million.

Prospecting is continually going on and new discoveries are made frequently. The next ten years, I confidently expect, will show a marked increase in production and development of our minerals. With our population steadily increasing a larger local trade will be the result; Canadian capital is now being invested on a larger scale, and if certain changes in the tariff can be arranged it will tend to make the markets easier of access, enlarge same and thus raise the market price of our commodities.

It will be remarked that the copper, phosphate, asbestos and iron industries are well established, and in a fair way to ample development. Mica is making rapid strides, while ochre, I consider, must also become important. Gold mining in Beauce, if I am not mistaken, will, before long, meet with the attention it deserves, and we may expect to see our graphite regularly worked in the near future, as well as petroleum in Gaspé and the central portion of the Province, which, in addition, contains natural gas, as yet untouched. Other minerals such as galena, rich copper ore, chromic iron, antimony, etc., are worthy of attention. We have no coal in our Province, but fuel (wood) is plentiful, and will be so for some time to come; after a certain time, however, I have no doubt that our practically inexhaustible beds of peat will come into use.

As a matter of fact our mining industries give direct employment to over 3,000 hands, not including those required for transportation, etc.

I would now remark that to-day we see in this province mining industries established on a sound basis, constantly increasing and improving, while at the same time we must admit that the majority are, so to speak, only in their infancy, but bid fair to rival those above mentioned. Altogether the outlook is encouraging in a great measure. It is my opinion that as our population increases and civilization advances, new discoveries will be made, capital invested and the mining industries of the province eventually become the leading business of the country instead of timber, as at present. Favorable customs arrangements with other countries would give a great impetus, I consider, to the mining business of our province.

The present mining law gives satisfaction, and with the co-operation of the mining community, will materially assist in the development of the resources of our province.

I look upon the General Mining Association of the Province of Quebec as an important body, and consider that its efforts, if well directed, cannot fail to be of great advantage in many ways to the country.

Subjoined I give some statistics relating to this province's production for the year ending 31st December, 1892; it was impossible to get complete returns in time for this meeting, however.

STATEMENT OF PRODUCTION OF MINERALS, ETC., IN THE PROVINCE OF QUEBEC, FOR THE YEAR ENDING 31ST DECEMBER, 1892.

Description.	Hands Employed.	Output.	Shipments.	
Copper ore...	538	57,641 tons	53,415	tons
§Gold........	70	350 oz.		
Iron ore.....	1,149†	28,090 tons	8,750	"
Asbestos.....	Returns incomplete		‖5,491¾	"
Phosphate....	do		*‡9,060	"
Mica........	do			
Plumbago ...	.....	......	4,590	cwt.
Galena.......	.....	......	15	tons
Soapstone....	.....	......	40	"
Granite......	.....	......	Over 100,000	c.ft.
Slate........	Returns incomplete			
Ochre.......	do		About 1,100	tons

*It is reported that about 2,000 were shipped from other points.
§Some small workings have not been reported.
†[It ought to be explained that the whole of the above force cannot be properly charged to the production of iron, nor is it employed all the year round. The Canada Iron Furnace Company for instance is the principal producer and a large proportion of its labor is engaged in cutting and hauling lumber, in making brick and other work incidental to the various operations of the company.—Secretary.]
‖From Eastern Townships.
‡From Montreal, principally from this province.

MEMBERS DINE TOGETHER.

In the evening about twenty-five members sat down to dinner in the Windsor Hotel. Capt. R. C. Adams presided. The proceedings were entirely *sans ceremonie*, the evening being spent in songs and impromptu speeches.

CAPT. ADAMS, in opening the proceedings said:—It is very well for us to try and reform the Constitution of the Association, but I think that it is more important for us at a banquet like this to attend to our own constitutions. And I think also that while it is well for us to enlarge our brains, it is still more important for us to enlarge our hearts; and I look on this social feature of the Association as perhaps the most valuable. What we gain by rubbing up against each other in hearty association does us perhaps more good than all we can learn from our very wise papers. I think too, that we are very fortunate in being miners, because after a somewhat extensive connection with the world I have come to the conclusion that the most interesting people in the world are the miners. I do not think there is any profession which gives a man so wide a range of view as that of mining. I am told that in McGill College the very best course of instruction is that of mining engineering, because it brings one into contact with so many different branches of knowledge. The miner, unlike the sailor, has to be master of all trades and jack of none. I never heard of but one fault laid to mining, and it was alluded to by a newspaper, which said that George Washington would never have obtained his record for veracity if he had been a mining engineer, and had had to send in a weekly report of progress. There has sometimes been a little doubt as to the veracity of the mining engineer, I admit; but the profession is a romantic one. The mining engineer has in his vocation a great deal that is calculated to stimulate his imagination before him, and it is not a matter of wonder if he is tempted to go a little ahead of the facts. But very often the facts get ahead of the imagination.

I think too, that miners are not only the most interesting people, but also the most useful. They are the pioneers of civilization. In a new country the hunter goes first, marks out a little track, and finds a little bit of stone which he brings in. And then the miner goes out and pitches his camp and civilization follows. A settlement springs up, and you will find that it was the miner who was the pioneer. It was owing to the hardy miner of '49 that the great Pacific slope was settled up, and that that region has become the Garden of Eden of the modern world, and that the great Pacific railroads have crossed the continent, and been the means of building up homes for millions of farmers. It was the miner who was the pioneer of all this western civilization. So that we may claim credit for our industry as having been not only productive of interesting men, but also as having been one of the great civilizing forces of the age.

It is well for us to take a little praise to ourselves, especially in a profession where so much is unappreciated and looked upon as a matter possessing little sentiment. You remember the story of the clergyman, who at a funeral in Colorado, attempted to make a quotation from one of the poets. He desired to say: "Death loves a shining mark;" but he got a little mixed, his feelings overcame him, and he said: "Death loves a mining shark." It is said that three-fourths of the congregation got up and left the church, feeling that it was a personal reflection. I think gentlemen that it is well for us to have these occasions of good cheer, for we all occasionally have our dull moments even in that exciting pursuit of mining. We have not prepared any set list of toasts for to-night. We want to have a happy family and informal gathering; and we are going to begin right up here with the mining men, and then with our guests, and ask each one of them to give us his wit and wisdom.

Captain Adams concluded his remarks by reciting in splendid style the following lines entitled,

THE PROSPECTOR'S SOLILOQUY.

"To sink or not to sink; that is the question;
Whether 'tis better in the prospector to sell
The highly metalliferous cropping for a song
Or, using muscle, dig her down
And thus by perseverance strike it. To sink, to work
No more; and by that sinking, strike a lead
Of gold or silver, or the finest copper glance

That luck is heir to. 'Tis a consummation
Devoutly to be wished. To sink, to blast.
To blast, perchance to "bust;" ay, there's the rub;
For at the depth of ten feet what base may come
When we have shoveled off the uncertain top,
Must give us pause. There's the respect
Which makes calamity of a prospect hole;
For who can tell what "pinch" may come below
The argentiferous stuff? Component parts of lead;
The metalliferous decomposed, conglomerate
Corruption of nature, all broken up; perchance
The insolence of luckier blokes. And then the chance
The miner takes by shafting,
When he himself might be much better off
By simply waiting. What would we not do
But that the dread of something yet unseen—
The undiscovered pay streak (perhaps not there)—
The argentiferous conundrum—puzzles the will
And makes us rather raise the monument we have
Than open up the ground we know not of.
Thus prospecting doth make cowards of us all;
And thus the prospects of a big bonanza
Are sickered with some dark and cussed doubt,
And speculators in a surface prize
With this regard their interest turn aside
And lose, perchance, a million."

An enjoyable programme of music and a number of toasts were given during the evening.

THE DUTY ON MINING MACHINERY.

MEETING OF COMMITTEE.

SHERBROOKE, 12TH MAY, 1893.

The joint committee of machinery manufacturers and mineral operators appointed to prepare a statement of the mining machinery made in Canada in accordance with Resolution under date of 7th April, met in the offices of the Gresselli Chemical Company, Sherbrooke, on 12th May.

There were present :

F. A. Halsey,	L. A. Klein,
J. M. Jenckes,	John Blue,
J. S. Mitchell,	F. P. Buck,
J. Burley Smith,	B. T. A. Bell,

B. Rising.

After discussion it was resolved to recommend that the Association memorialize the Dominion Government to alter the language of the present law respecting the admission of mining machinery so as to read :

> "That all machinery and appliances for mining, quarrying, smelting, concentrating, refining and treating ores or minerals, of a class or kind not manufactured in Canada, be admitted free of duty."

On motion of Mr. J. S. Mitchell it was resolved to recommend also that "all steel rails exceeding 25 lbs. in weight for use in mines and quarries be admitted free of duty."

The Secretary then submitted a statement showing the various classes and kinds of mining machinery known to be made in Canada, together with those which were known not to be made and which were being imported. He stated that a circular had been addressed to every machinery manufacturer in the Dominion, asking them to furnish particulars of their manufactures, and that an invitation had been sent to each to send representatives to this meeting. The information given in response to these circulars had been embodied in the statement, which he thought was fairly complete.

Messrs. Halsey and Jenckes made objection to furnishing the department with any statement showing machinery that was not manufactured, claiming that a statement of what was made would serve the purpose equally well. After discussion this was agreed to.

The committee then proceeded to discuss the statement of machinery made which, after some alterations, was adopted, and the Secretary was authorized to forward it to the Mining Society of Nova Scotia for its endorsation, prior to the meeting of the Association on 5th July. The meeting then adjourned.

QUARTERLY GENERAL MEETING,

SHERBROOKE.

WEDNESDAY, 5TH JULY, 1893.

The summer meeting of the Association was held in the Art Hall, Sherbrooke, on Wednesday, 5th July.

There were present:

R. T. Hopper (Anglo-Canadian Asbestos Co.), Montreal.
F. P. Buck, Dominion Lime and Marble Co.) Sherbrooke.
Col. Lucke and J. S. Mitchell (Beaver Asbestos Co.), Sherbrooke.
John J. Penhale (United Asbestos Co.), Black Lake.
L. A. Klein (American Asbestos Co.), Black Lake.
Capt. John J. Williams (New Rockland Slate Co.), New Rockland.
S. L. Spafford and A. W. Elkins (Nichols Chemical Co.), Capelton.
John Blue (Eustis Mining Co.), Capelton.
F. C. Thomson, Sherbrooke.
John McCaw, Sherbrooke.
George R. Smith (Bell's Asbestos Co.), Thetford Mines, Que.
John W. Jenckes, Sherbrooke.
B. T. A. Bell, Ottawa.

In the absence of the Hon. George Irvine, Q.C., President, Mr. R. T. Hopper was called to the chair.

ELECTION OF NEW MEMBERS.

The Secretary read the names of the following gentlemen who had been elected to membership since last meeting:—

Frank Gilbert, Gilbert Engineering Co., Montreal, Que.
James S. Mitchell, Beaver Asbestos Co., Sherbrooke, Que.
S. L. Spafford, Nichols Chemical Co., Capelton, Que.
A. W. Elkins, Nichols Chemical Co., Capelton, Que.
J. N. Greenshields, Q.C., Danville Slate Quarry, Montreal, Que.
Wm. King, King Bros., Thetford Mines, Que.
D. L. Lockerby, Montreal.
J. R. Woodward, Sherbrooke, Que.
Fernando Wadsworth, American Gold Co., Gilbert River Gold Mines, Que.
C. N. Martin, Eustis Mines, Capelton, Que.
F. C. Thompson, Sherbrooke, Que.
Frank Gundry, Sherbrooke, Que.
Capt. W. Prideaux, Black Lake, Que.
John McCaw, Sherbrooke, Que.

INVITATION FROM THE MINING SOCIETY OF NOVA SCOTIA.

THE SECRETARY read the following telegram :—

"HALIFAX, 5th July, 1893.

"Mining Society of Nova Scotia will hold September meeting in Halifax, and extends to General Mining Association of Quebec cordial invitation to participate.

[Signed] H. M. WYLDE, *Secretary.*"

He would move that the September Quarterly Meeting of the Association be not held, and that the invitation of the Mining Society be accepted.

MR. F. P. BUCK—What is the date in September?

MR. BELL—The date is left open.

MR. BUCK—Accept the invitation and get as many as we can to attend.

MR. JOHN BLUE—I second the motion.

MR. G. R. SMITH thought that the Association might easily arrange to run a car from Montreal.

THE DATES OF MEETINGS.

MR. F. P. BUCK—We should meet twice a year instead of four times. If this were done, greater interest would be taken in the proceedings, and the attendance would be increased.

MR. BELL—In order to effect such a change, notice would have to be given to amend the Constitution.

MR. KLEIN—Three-fourths of the members present can decide the point.

MR. BELL—No; notice of motion must be given.

MR. JOHN BLUE—I think we ought to have three meetings; one in the Ottawa district, one in the Townships, and one in Montreal.

MR. WOODWARD agreed with Mr. Blue that three meetings only were desirable.

Mr. BUCK having expressed himself as agreeable, Mr. Blue gave notice of motion to amend the Constitution in this particular.

THE DUTY ON MINING MACHINERY.

THE SECRETARY read the statement of the various classes and kinds of mining machinery manufactured in Canada which had been prepared by sub-committee at a meeting held in Sherbrooke on 12th May. It had been forwarded to the Mining Society of Nova Scotia who had added to it, and had returned it duly confirmed. The sub-committee recommended that the Association ask the Government to have the language of the Act changed to read: "That all machinery and appliances for mining, quarrying, smelting, concentrating, refining and treating ores or minerals of a class or kind not manufactured in Canada, be admitted free of duty." They would remember that the Act as at present worded restricted the free entry to machinery for mining purposes only. The committee was also of opinion that steel rails exceeding 25 lbs. in weight for use in mines and quarries should be admitted free of duty. At the meeting of the Mining Society of Nova Scotia, Mr. J. F. Stairs, M.P., had stated that all rails over 25 lbs. were admitted free of duty.

MR. MITCHELL—That is rails for railway purposes only; not tramways.

MR. BELL—I understood the Act read for railways and tramways.

MR. WOODWARD moved that the report of the sub-committee which met in Sherbrooke on 12th May be adopted, and that a copy of the resolution containing the clause relating to steel rails, be forwarded to the Minister of Customs.

MR. BLUE—I second Mr. Woodward's motion. The motion was carried.

THE POWDER MAGAZINE LAW.

THE CHAIRMAN—Some time ago, when the Association was discussing the powder license question, the point was incidentally introduced that as the law stood at present no mining magazine in the province was constructed according to the Act, and that any accident would probably render the owners responsible for damages in the event of loss of property or lives, as well as render them liable at any time to the payment of a fine for not complying with the requirements of the Act. At the time, this suggestion received scant consideration, as it was generally considered by those present that the Act was not intended to cover the storage of mining explosives, but rather was meant to regulate the storage and sale of explosives in the neighborhood of large cities. Some time ago one of his workmen was slightly injured by an explosion of the powder house during a thunderstorm, and he brought an action to recover damages. A judgment was given in our favor in the court of first instance, on the ground that the non-compliance with the Act above referred to, subjected the company to a fine for such non-compliance, but did not render us liable to damages for injuries resulting therefrom. In the Court of Review, however, judgment had recently been given reversing that of the court below, on the ground that notwithstanding the fact that the accident was caused by lightning, and, therefore, beyond our control, still that his company was responsible for the damage because they had not erected a powder magazine in accordance with the terms of the Act.

MR. MITCHELL—If lightning struck a building built according to this law at your place, what would have been the result?

MR. HOPPER—Great destruction of life and property would have been inevitable.

MR. KLEIN—I saw the report of Provincial Revenue Inspector Poston, when he was around inspecting the powder houses. He recommended the present style of power house, built of boards and shingles, as the only proper style. The Government has evidently accepted this opinion of Mr. Poston and have issued licenses for 1891 on this report.

Mr. Hopper—The law has not been changed.

Mr. Woodward—Then the law should be amended according to Inspector Poston's recommendation.

Mr. John Penhale—The man suing for damages in this case had no business on the property all, and yet Mr. Hopper's company was held for damages. Might not such a thing occur to any one of us, even if the inspector accepted our license cheque, and passed, in his report, the construction of our magazine?

Mr. Buck moved, seconded by Mr. G. R. Smith, that Messrs. R. T. Hopper, J. S. Mitchell and John Blue, be named a committee to watch legislation respecting powder magazines and licenses. The motion was carried.

THE EUSTIS MINE.

By Mr. John Blue, Capelton, Que.

The copper deposits of the Capelton district occur in the precambrian formation, which comes to the surface over a large extent of country. The formation also contains beds of dolomite limestone, bands of dioritic rock and soft clay slates, and the whole is crossed with trap dykes which do not cause any displacement of the strata.

The ore deposits in the district are all found running in a north-east by south-west direction, with the stratification, which is composed of crystalline schists, generally of a talcose or micaceous nature.

In the records of the Geological Survey of Canada for 1863, Sir William Logan gives as his opinion that "the origin of the copper veins are contemporaneous with the rock formation, having been reduced to the state of sulphurets, and precipitated at that time with the sediment." At the time this opinion was advanced, comparatively little mining work had been done; but now that the formation has been exposed by some 25 or 30 years work, the generally adopted theory of the origin of the veins is attributed to segregation.

But whether formed by precipitation or segregation, the veins are undoubtedly irregularly stratified deposits, following the bedding, and interposed between the associated rocks.

In the district there are a large number of different and distinct veins running parallel with each other, and at the present time work is being done in four of them. On a number of the others more or less work has been done, but only on or near the surface, so as yet they can only be considered as but very imperfectly explored.

The vein on which is located the Eustis mine of the Eustis Mining Co., and also the Albert mine, operated by the Nichols Chemical Co., has been worked for some 30 years off and on, and continuously for the last 15 years. It is, so far as known now, the strongest and most persistent deposit in the district, extending laterally for over two miles, and in depth on the slope of the vein in the Eustis mine, to over 2,000 feet at this time, and at the lowest point the ore body is as strong and solid as ever, and has every appearance of continuing so for an indefinite depth.

The foregoing remarks being given as the general characteristics of the Capelton and surrounding mineral district, the notes to follow will refer specially to the subject of this paper, "The Eustis Mine."

The Eustis Mining Co., originally the Orford Nickel and Copper Co., and later on the Orford Copper and Sulphur Co., commenced operations in 1879, on Lot 2, Range 9, Township of Ascot, nine miles south of the city of Sherbrooke, Quebec Province, leasing the shaft known as No. 5 Hartford, which was sunk to a depth of 500 feet, in the property then owned by the Canadian Copper and Sulphur Co., and now by the Nichols Chemical Co. of New York.

At that time the only means of reaching the ore bodies in the Eustis Mining Co's lands was through this No. 5 shaft, for the reason that the vein crops out on the surface about 200 feet north of their line, and crosses it at 500 feet from the surface, measuring along the slope of the vein.

Under these circumstances—being at the mercy of a foreign corporation, who might at any time refuse to renew a lease of their shaft, and so stop all operations, and for other important reasons—it was decided to take steps to confine all operations within the company's own boundaries, and to do so it was necessary either to sink a vertical shaft to strike the vein, or reach it by a cross-cut into the mountain. After mature deliberation, a cross-cut or tunnel, as it is called, was agreed upon as the best method, and subsequent operations have confirmed the soundness of this decision.

This tunnel is nearly 1,000 feet in length, about seven feet high, by seven feet wide, and has a decending grade from the inside of six inches per 100 feet—enough to carry off the water from the upper workings.

The vein, as already mentioned, is an interstratified bed, running in a north-east and south-west direction. The dip is to the south-east and is very irregular, in places being almost perpendicular, and in others nearly horizontal. The average slope is between 35 and 40 degrees from the horizontal. The irregularity of the dip may be accounted for at the period of disturbance by unequal pressure at different points, thus producing a partial folding of the stratification.

The hanging walls generally are smooth and regular, conforming to the bedding of the associated rocks; but in the footwall numerous depressions or crevices filled with ore occur. These are found in many different forms, sometimes having the appearance of branch veins running up and down the slope, others apparently branches running laterally across the vein, and again some are basin-shaped hollows or "squats," occasionally 20 to 30 feet deep, but all of them coming to an abrupt termination, and all showing the extreme irregularity of the bed on which the vein matter was first deposited.

Horses of country rock and boulders of greenstone are of frequent occurrence in the vein.

Four trap dykes running almost parallel with each other in a N.E. by S.W. direction, cut vertically through the vein, but do not disturb or affect it in any way, a proof that they have had their origin subsequent to the formation of the vein, and in all likelihood since the stratification was tilted up into its present position.

Slides or displacements of the vein are met with in three places, one of them being an upthrow of 25 feet, the others causing displacement of only one or two feet. These do not change in any way the general characteristics of the vein or vein matter, and are also disturbances which have taken place since the stratification assumed its present position.

The ore occurs in large bodies or lenticular masses, narrowing down laterally to small dimensions. The vein is continuous between these masses, but it is too small to work and is besides usually low grade in quality.

The deposit being worked has a length of about 350 feet, and varies in width from 3 feet at the extreme ends to over 60 feet at the widest part of the chamber.

The ore is copper pyrites, and varies in copper contents from 2 to 30 per cent. The sulphur varies also according to the amount of copper and silica in the ore, some samples showing 48 per cent. and others only about 30 per cent. An analysis of an average sample of the whole deposit would show about 42 per cent. of sulphur, 4 per cent. of copper, also 3 ozs. of silver, and about 40 cents worth of gold per ton of 2000 lbs.

The ore is bi-sulphide, burns very freely, and is admirably adapted for making sulphuric acid.

The method of mining now in use was adopted to suit the peculiarities of the deposit, and differs from the ordinary plan of sinking shafts, driving drifts, sinking winzes, etc., in that two shafts are sunk in the ore body on the slope of the vein, about 175 feet apart, each of them carrying down from 40 to 50 feet in length of the vein, and the full width from foot to hanging wall; the shaft work in this way being practically underhand stoping. The shafts diverge from the same landing till the necessary distance between them is obtained; from this point a curve in one shaft allows of their running parallel to each other.

The reserves of ground opened up by this system of sinking consist of the body of ore between the two shafts about 125 feet in thickness or length, and the two bodies outside of the shafts, each from 50 to 75 feet in length.

The advantage claimed for this system of working is economy—first in sinking shafts, always an expensive part of mining work, but in this case costing it may be said absolutely nothing, as the ore can be obtained from the shaft work at as little cost as from any stope in the mine of the same character. Again, drifts are dispensed with except in special cases, such as connecting the shafts for ventilation, for exploratory purposes, or for some peculiarity of the formation, and winzes or rises are unknown except in the case of working around pillars.

The reserve ground is worked out by breast and underhand stopes; back stopeing being resorted to and only possible from the exploratory or ventilating drifts.

The skip tracks are protected from the blasting operations by heavy timbers, lagged to the hanging wall and put in alongside the tracks and running parallel with them. These timbers are necessary in any case, as the hanging rock is of a slatey, seamy nature, liable to wind and break off when exposed to the action of air and moisture.

One of the objections to working out the deposits by the usual method of drifts and winzes, is the closeness to each other that it would be necessary to have these drifts or levels; this being caused by the irregularities in the footwall, and the numerous steps or flat places on which the broken ore would lodge, making it necessary in many cases to handle the ore several times before it finally reached the levels.

With the system in use each or any of these steps may be utilized as a level, along which the ore is conveyed to the plats or bins at the hoisting tracks. About the only serious objectionable feature in the method of working is the difficulty in keeping the skip tracks in place in the bottom of the shafts, these being frequently broken or displaced by the blasting operations, although protected by heavy timbers. But this difficulty is more than counterbalanced by the many advantages of the method, of which the easy handling of the ore after it is broken, is one—this being practically loaded from the blasts into the cars.

The roof of the mine is supported by pillars of ore left standing in suitable places, and also by timbers, but the ground is usually firm and solid and easily held in place, except in places where the strata is cut through by slides or dykes, and at these points heavy ground is always met with. In all other places protection is needed only from the bands of slatey rock that are partially loosened by blasting and exposure to air and water.

The mining work is all done on the contract system—all contracts being renewed at the beginning of each month. By this system, the miners having to pay for all the supplies they use, economy is ensured, and at the same time a fair day's work has to be done every day or the miners feel the effects of it at the end of the month.

The average wage made by miners is from $40 to $50 per month, and occasionally $60 is made—the difference being due to the greater or less skill and ability of the men in their way of working.

Laborers are paid at the rate of $1.25 per day of eight hours—three shifts being worked in the 24 hours.

There are about 200 hands in all employed in and out of the mine. Of these about 20 are boys employed in ore dressing.

The mine is remarkably free from water; five or six hours pumping per week keeping it dry. The pump used is a Deane, with 6 in. cylinder and 10 in. stroke. The suction is 3 in.; discharge, 2 in.; vertical lift, about 175 feet.

Nearly all of the water comes from the surface and upper stopes, and the greater part of it is caught and carried out of the tunnel without pumping. The bottom of the mine is so dry that miners occasionally have to carry down water for drilling purposes.

The water is so strongly charged with acids and copper in solution, and is so destructive to iron, that it is necessary to have the water end of the pump, piston, piston rods, etc., made of brass.

The water, when it leaves the tunnel, is caught in troughs and run over scrap iron, on which the copper in solution is precipitated. About two tons of cement, carrying 50 to 60 per cent. of copper is collected in this way yearly.

Two air compressors, one a straight line Ingersoll, 20 in. x 30 in. cylinder, the other a Rand compound 14 in. x 22 in. cylinder with condenser, and each of 10 to 12 drill capacity, furnish the compressed air for drilling. Rand and Ingersoll-Sergeant power drills are used, and eight of them are kept running night and day.

Hand drilling is resorted to only in very small veins or inaccessible places.

The compressors, with two boilers 18 ft. by 6 ft. diameter to run them, are set up outside the mine, and the air carried from them through the tunnel and down the mine in 4½ and 4 inch pipes to a point where it is diverted in smaller pipes to the different workings.

The mine is ventilated by diverting the air which goes in through the tunnel, and confining it by a tight brattice or dividing along the west side of the mine till it reaches the working stopes. It is there scattered through the workings and naturally finds an exit on the top of the mountain through Nos. 5 and 7 shafts. The exhaust from the drills also contributes to the ventilation of the mine.

The hoisting machinery is all set up in the mine at the inside end of the tunnel, and consists of two engines with 14 in. x 26 in. cylinders, coupled on to opposite ends of the main shaft. Three drums 6 ft. 6 in. in diameter are geared to this shaft, two of them being in use, and the third kept as spare in case of breakage. Two boilers 4 ft. x 16 ft. furnish the steam to run the winding engines. The smoke from the boilers and the exhaust steam is carried up to the surface through the old workings of No. 5 shaft, partly in an iron smokestack 26 in. diameter, and partly in two columns of vitrified clay pipe, each 18 in. diameter. The total length of this chimney is 520 feet.

The rope used on the winding drums is made of the best crucible cast steel. It is 1 in. diameter, has 6 strands with 7 wires in each strand, and hemp centre. The breaking strain is 25 tons; load about 4½ tons.

The skips or ore cars in use are made of steel, 5 ft. long, 3 ft. wide and 2½ ft. deep, and hold about two tons. These cars are taken directly from the landing by horses, and hauled to the dressing shed, a distance of about 2,000 feet. The ore is dumped out of the cars on to a series of screens, which size it into roughs, pickings and fines. The rough ore and pickings are dressed by hand, the latter being first washed. The fines, which includes all that goes over a ¾ in. screen, is taken to the jigging plant, and is first put through a revolving screen, dividing it up into coarse pea from ¾ in. to ½ in.; fine pea from ½ in. to ¼ in.; and fines, taking in everything under ¼ in.; each size being put through their own jigs and shipped separately.

The ore, after dressing, is taken directly in cars carrying about 9,000 lbs., to the Boston and Maine railway siding, and is there loaded into cars for shipment. The distance from the dressing shed to the railway is 2,200 ft., and in that distance there is a fall of 180 feet. In the first 400 ft. from the shed, the cars are let down 80 ft. by means of a counter-balance tramway, the loaded cars going down taking the empties up. The rest of the way has a descending grade of 4½ ft. per 100, down which the loaded cars run by their own gravity—the empties being hauled back by horses.

The ore is all shipped in the raw state to different places in the United States, and the first treatment is in converting the sulphur contents into sulphuric acid. The cinders from this process are then smelted and refined, the copper, silver, and gold being all extracted in the final process.

The output of the mine at the present time is at the rate of about 3,000 tons of dressed ore per month, and has averaged this quantity for a year or two back.

The mine, since it was first opened, has produced somewhere about half a million tons of ore, and judging from the general appearance of the vein in the bottom, it will in all likelihood produce as much more, and possibly be a long way from being worked out then. At any rate there is in sight in the mine to-day over one hundred thousand tons of ore, and the vein in the bottom of both shafts is strong and solid as it ever was.

If there is anything in the old miner's theory that a vein continues in depth as far as it does in length, then the ore that may be expected to be produced will have to be counted by the millions of tons.

There is a smelting plant on the property, but it has not been in use for some years, consisting of roasting ovens of a capacity of 1,200 tons a month; two water jacket cupola furnaces, with engines, boilers, fans, etc., capable of smelting 2,000 tons of ore monthly.

MR. J. R. WOODWARD moved a vote of thanks to Mr. Blue.

MR. S. L. SPAFFORD, seconded.

PEAT FUEL BY THE DICKSON PROCESS.

By. A. A. DICKSON, Toronto.

Peat is a vegetable substance and is produced in several ways, viz:—By the decomposition of forests, by the growth and decomposition of grasses, and the decomposition or disintegration of the Sphagnum moss, but the best and purest peat found in Canada is produced from the Sphagnum moss which grows on ponds and comparatively shallow lakes.

Peat produced by the latter process forms very rapidly, the moss making very rapid growth, and can be found in bloom at the top while it is disintegrating or decaying at the bottom. This mass grows on the top of the water and as it is gradually disintegrated by the action of the water its own weight makes it gradually sink, and if the growth is old and the depth of the water in the lake not too great it will in time decend to the bottom. It is not generally known that the average peat bog is floating on the top of the water like a plank or board, sinking only as its own weight increases, but such is the case. I know of one large bog in the province of Quebec, covering about one thousand acres, which some seventy-five years ago was an open lake. I have conversed with an old resident who when he was a boy used to fish and shoot water fowl on the then lake. At the present time there are three lines of railway running through it. Such has been the rapid growth of the Sphagnum moss. In some places the peat reaches a depth of nine or ten feet, the whole, with the exception of that portion close to the shores, floating on the top of the water.

Its Calorific Value as a Fuel—The elements of peat are essentially the same coal, save and except the sulphur and phosphorus, viz:—carbon, hydrogen, oxygen, and nitrogen. Its freedom from sulphur and phosphorous is a very essential matter, especially for the smelting of ores. It does not require coking or reducing to charcoal but can be used direct from the machine, although it will stand to be coked and charcoaled equally well with coal. It is extensively used in an air-dried state only in Norway and Sweden for the reduction of iron ores, and some of the finest brands of iron are smelted with peat. It makes more homogenous iron than coal, being very similar to a charcoal iron. In some of the European countries it is being used exclusively for railway purposes. They find it cheaper than coal, the only disadvantage being its bulk. They require specially built vans to carry it in its crude state. It is very dirty to handle as well as bulky, but its freedom from clinkers and cinders and the absence of sulphur, which creates sulphurous acid to eat up the fire boxes and grate bars, is very important. In an experiment made on the Grand Trunk Railway some years ago, the the details of which I have before me, air-dried peat, containing 20 per cent. of water compared favorably with bituminous coal. The peat stood 80 as to 100 of coal, or one ton of peat being equal to four-fifths of a ton of coal. Compressed peat is, however, so far ahead of the old air dried material that it may be classed as coal. Its specific gravity is 1.49 weighing 93 lbs. per cubic foot, anthracite coal weighing 93.5 lbs. per cubic foot, its specific gravity being 1.5, and bituminous coal weighing 86.89 lbs. per cubic foot, its specific gravity being 1.39—thus it will be seen that peat produced by the Dickson process will not occupy any more space than the best grades of coal; consequently it will be readily seen that the one great objection which has prevented the more universal use of peat for fuel has been entirely overcome and done away with. In a very severe test made at the John Abell Engine Works, in Toronto, the details of which I have before me, 457½ lbs, of Dickson's compressed peat was tested against an equal amount of anthracite lump coal. The test was made on a coal burning grate which is not quite suitable for the burning of peat, inasmuch as the surface is entirely too large. The temperature of the boiler house when the peat was used stood at 69 above zero; when the coal was used it stood at 82 above, making a difference in favor of coal of 13 degrees. When the peat was used the weather was dull, when the coal was used the weather was bright and sun-shining,—this to those acquainted with steam is a very material difference in favor of the coal; notwithstanding, the 457½ lbs. of compressed peat kept steam up steadily at 85 lbs. exactly two hours, while the anthracite coal kept it steady at 85 lbs. for two hours six and one-half minutes only. Under similar conditions of temperature, with the proper type of grate, peat would have done as well if not better than the anthracite coal.

Compressed peat fuel produced by the Dickson process is equal to coal in its specific gravity, equal to coal it its calorific power, free from cinder and clinker, cleanly to handle, free from sulphur and phosphorus, contains all the volatile combustible elements found in the bog, cheaply and easily produced, filling the greatest want of the present day. We are looking forward to this new industry keeping millions of dollars in our own country, which at the present time is sent to our neighbors on the south of us; for whom however I entertain the highest regard, but until a closer union is established between the two countries, politically or commercially, we must look to the welfare of our own people. Time will not permit me to go further at present, but if you so desire it I will be pleased to furnish more particulars at another time.

On motion of the Secretary, a hearty vote of thanks was tendered to Mr. Dickson for his contribution, and to Mr. F. P. Buck and his associates of the local committee, for the admirable arrangements made for the reception and entertainment of visiting members of the Association during the meeting.

EXCURSION TO LAKE MEMPHREMAGOG.

On Friday morning visiting members and their lady friends, together with many prominent citizens of Sherbrooke, in all a party of some seventy ladies and gentlemen, participated in a delightful excursion to Newport and Lake Memphremagog.

APPENDIX.

CONTENTS.

OFFICERS AND COUNCIL.

—

YEAR 1891–2.

—

President:

Hon. George Irvine, Q.C., (Johnson's Co., Limited), Quebec.

Vice-Presidents:

Hon. George A. Drummond (New Rockland Slate Co.), Montreal.
Robt. N. Hall, Q.C., M.P. (Nichols Chemical Co.), Sherbrooke.
Capt. R. C. Adams (Anglo-Canadian Phosphate Co.), Montreal.
R. Prefontaine, Q.C., M.P., Montreal.

Council:

James King (King Bros.), Quebec.
S. P. Franchot (Emerald Mining Co.), Buckingham.
L. A. Klein (American Asbestos Co.), Black Lake.
W. H. Irwin (Anglo-Canadian Asbestos Co.), Montreal.
F. J. Falding (Gresselli Chemical Co.), Sherbrooke.
A. Lomer (McLaurin Phosphate Syndicate), Montreal.
Col. Lucke (Beaver Asbestos Co.), Sherbrooke.
O. M. Harris (Canadian Phosphate Co.), Montreal.
J. Burley Smith (British Phosphate Co.), Glen Almond.

Treasurer:

A. W. Stevenson, C.A., 17 St. John Street, Montreal.

Secretary:

B. T. A. Bell, 17 Victoria Chambers, Ottawa.

OFFICERS AND COUNCIL.

—

YEAR 1892-3.

—

President:

Hon. George Irvine, Q.C. (Johnson's Co.) Quebec.

Vice-Presidents:

Capt. R. C. Adams (Anglo-Canadian Phosphate Co.), Montreal.
R. Prefontaine, Q.C., M.P., Montreal.
S. P. Franchot (Emerald Mining Co.), Buckingham.
James King, M.L.A. (King Bros.), Quebec.

Council:

D. A. Brown (Bell's Asbestos Co.), Boston.
J. Lainson Wills (General Phosphate Co.), Ottawa.
O. M. Harris (Canadian Phosphate Co.), Montreal.
Dickson Anderson, Montreal.
John J. Penhale (United Asbestos Co.), Black Lake.
Col. Lucke (Beaver Asbestos Co.), Sherbrooke.
J. Burley Smith (British Phosphate Co.), Glen Almond.
R. T. Hopper (Anglo-Canadian Asbestos Co.), Montreal.
L. A. Klein (American Asbestos Co.), Black Lake.

Treasurer:

A. W. Stevenson, C.A., 17 St. John Street, Montreal.

Secretary:

B. T. A. Bell, 17 Victoria Chambers, Ottawa.

OFFICERS AND COUNCIL.

—

YEAR 1893-4.

—

President:

Hon. George Irvine, Q.C. (Johnson's Co.), Quebec.

Vice-Presidents:

Capt. R. C. Adams (Anglo-Canadian Phosphate Co.), Montreal.
James King, M.L.A. (King Bros.), Quebec.
John Blue (Eustis Mining Co.), Capelton.
R. T. Hopper (Anglo-Canadian Asbestos Co.), Montreal.

Council:

F. P. Buck (Dominion Lime Co.), Sherbrooke.
J. Burley Smith (British Phosphate Co.), Glen Almond.
George E. Drummond (Canada Iron Furnace Co.), Montreal.
L. A. Klein (American Asbestos Co.), Black Lake.
S. P. Franchot (Emerald Mining Co.), Buckingham.
W. H. Irwin (Anglo-Canadian Asbestos Co.), Montreal
His Honor Judge Dugas, Montreal.
John J. Penhale (United Asbestos Co.), Black Lake.
Col. Lucke (Beaver Asbestos Co.), Sherbrooke.

Treasurer:

A. W. Stevenson, C.A., 17 St. John Street, Montreal.

Secretary:

B. T. A. Bell, 17 Victoria Chambers, Ottawa.

LIST OF MEMBERS.

*Those marked * are Original Members; × prefixed to a name indicates the Contributor of a Paper published in the Journal.*

HONORARY MEMBERS.

Elected.		
1893		Adams, Dr. F. D., *McGill College, Montreal.*
1893		Bell, Dr. Robert, *Geological and Natural History Survey, Ottawa.*
1893	×	Blue, Archibald, *Director, Bureau of Mines, Toronto, Ont.*
1891		Dawson, Dr. George, C.M.G., *Geological and Natural History Survey, Ottawa.*
1891		Dawson, Sir William, *Principal, McGill University, Montreal.*
1893	×	Ells, Dr. Robt. W., *Geological and Natural History Survey, Ottawa.*
1893		Gilpin, Dr. E., Jr., *Deputy Commissioner and Inspector of Mines, Halifax.*
1893	×	Gibson, T. W., *Bureau of Mines, Toronto, Ont.*
1893		Hardman, John E., S.B., *Oldham Gold Company, Oldham, N.S.*
1891		Harrington, Prof. B. J., *McGill University, Montreal.*
1893	×	Ingall, Elfric D., M.E., A.R.S.M., *Chief of Division of Mineral Statistics and Mines, Ottawa.*
1891		Laflamme, Rev. Father, *Laval University, Quebec.*
1893	×	Low, A. P., B. Ap. Sc., *Geological Survey, Ottawa.*
1893	×	McInnes, W., *Geological Survey, Ottawa.*
1893	×	Obalski, J., M.E., *Inspector of Mines, Quebec.*
1893	×	Poole, Henry S., M.A., A.R.S.M., F.G.S., *Acadia Coal Co. (Ltd.), Stellarton, N.S.*
1893	×	Raymond, Dr. Rossiter W., *Secretary, American Institute of Mining Engineers New York.*
1891		Selwyn, Dr. A. R. C., C.M.G., *Director, Geological and Natural History Survey of Canada, Ottawa.*

ORDINARY MEMBERS.

Elected.		
1891	×	*Adams, Capt. Robert C., (Anglo-Canadian Phosphate Co., Ltd.), *41 St. Francois Xavier St., Montreal.*
1891		*Allan, W. A. (Little Rapids Phosphate Mine), *17 Victoria Chambers, Ottawa.*
1893		Bacon, F., (Park Bros., Ltd.), *377 St. Paul St., Montreal.*
1893		Bacon, T. P. (New Rockland Slate Co.), *377 St. Paul St., Montreal.*
1891	×	*Bell, B. T. A. (Editor *Canadian Mining Review*), *17 Victoria Chambers, Ottawa.*
1892		Bell, W. E. (Toronto Bag Works), *P. O. Box 38, Montreal.*
1891	×	Blue, John (Eustis Mining Co.), *Capelton, Que.*
1893		Brainerd, Dwight (Hamilton Powder Co.), *103 St. Francois Xavier St., Montreal.*
1891		Brown, D. A. (Bell's Asbestos Co., Ltd.), *119 Federal St., Boston.*
1893		Buck, F. P. (Dominion Lime Co., Ltd.), *Sherbrooke, Que.*
1893	×	Carlyle, W. A., M.E. (Lecturer in Mining Engineering), *McGill University, Montreal.*
1893		Carrier, C. H. (Carrier, Lainé & Co.), *Levis, Que.*
1891	×	Cirkel, F., M.E. (Templeton Asbestos Co., Ltd.), *126 O'Connor St., Ottawa.*
1891		*Cooper, James (McGregor Lake Phosphate Co.), *203 St. James Street, Montreal.*
1893		Costigan, W. T., *196 St. James Street, Montreal.*
1893	×	Donald, J. T., M.A., *156 St. James Street, Montreal.*
1891		*Doucet, Theo., N.P., *St. James Street, Montreal.*
1891		*Drummond, Hon. George A. (New Rockland Slate Co.), *St. Francois Xavier Street, Montreal.*
1893		Drummond, George E. (Canada Iron Furnace Co., Ltd.), *New York Life Building, Montreal.*
1894		Drummond, T. J. (Canada Iron Furnace Co., Ltd.), *New York Life Building, Montreal.*
1894		Drummond, John J. (Canada Iron Furnace Co., Ltd.), *Radnor Forges, Que.*
1893		Dugas, His Honour, Judge (Mica Mine Owner), *Montreal.*
1893		Elkins, A. W., *Sherbrooke, Que.*

Elected.		
1891	×	*Evans, A. M., M.E. (King Bros.), *Black Lake, Que.*
1891		*Fleming, S. H. (Mine Owner), *Victoria Chambers, Ottawa.*
1891		*Franchot, S. P. (Emerald Phosphate Co.), *Buckingham, Que.*
1893		Futvoye, Isaac B. (Owner Mineral Lands), *St. John, Que.*
1892		Gardner, W. S. (Machinery Supply Co.), *Craig Street, Montreal.*
1893	×	Gibbs, W. T., F.C.S., *Ottawa, Ont.*
1893		Gilbert, Frank (Gilbert Engineering Co.), *Notre Dame Street, Montreal.*
1893		Gilman, E. W. (Ingersoll Rock Drill Co.), *St. Henri, Montreal.*
1891		*Green, F. Hilton (Phosphate of Lime Co., Ltd.), *30 St. Francois Xavier Street, Montreal.*
1893		Greenshields, J. N., Q.C. (Danville Slate Co.), *British Empire Building, Notre Dame Street, Montreal.*
1893		Grundy, Frank (Quebec Central Railway), *Sherbrooke, Que,*
1891	×	*Halsey, F. A. (Canadian Rand Drill Co.), *Sherbrooke, Que.*
1891		*Hanson, E. (Glasgow and Montreal Asbestos Co.), *Temple Building, Montreal.*
1891		*Harris, O. M. (Canadian Phosphate Co., Ltd.), *Atlantic Chambers, Commissioner Street, Montreal.*
1891		*Haycock, E. B. (Star Gold Mine), *46 Sparks Street, Ottawa.*
1893		Higginson, J. S. (Lomer & Co.), *Custom House Square, Montreal.*
1891		*Hopper, R. T. (Anglo-Canadian Asbestos Co.), *Board of Trade Building, Montreal.*
1891	×	*Irvine, Hon. Geo., Q.C. (Johnson's Co., Ltd.), *Quebec.*
1892		Jeffrey, H. J. (Mineral Broker), *44 Foundling Street, Montreal.*
1893		*Jeffrey, W. H. (Jeffrey's Asbestos Mine), *Richmond, Que.*
1891		*Jenckes, John M. (Jenckes Machine Co.), *Sherbrooke, Que.*
1893		Jenckes, S. W. (Jenckes Machine Co.), *Sherbrooke, Que.*
1892		Johnson, A. S. (Johnson's Co., Ltd.), *Thetford Mines, Que.*
1891		*King, James, M.L.A. (King Bros.), *Quebec, Que.*
1893		King, William (King Bros.), *Thetford Mines, Que.*
1891		*Klein, L. A. (American Asbestos Co., Ltd.), *Black Lake, Que.*
1893		Leofred, A., M.E., *Rue St. Louis, Quebec.*

Elected.		
1893		Lockerby, D. L. (Owner Mineral Lands), *St. Peter Street, Montreal.*
1891		*Lucke, Col. (Beaver Asbestos Co.), *Sherbrooke, Que.*
1894		McCall, John T. (Canada Iron Furnace Co., Ltd.), *New York Life Building, Montreal.*
1891	×	McRae, Hector (Electric Mining Co.), *Queen Street, Ottawa.*
1893		Macdonald, A. (Owner Mineral Lands), *St. John, Que.*
1891		*McIntosh, William (Owner Mineral Lands), *Buckingham, Que.*
1893		Martin, C. N. (Eustis Mining Co.), *Capelton, Que.*
1893		Mitchell, J. S. (Beaver Asbestos Co.), *Sherbrooke, Que.*
1892		Morgan, E. W. (Northey Manufacturing Co.), *Toronto, Ont.*
1893		Munro, Robt. (Canada Paint Co.), *Montreal.*
1894		Nichols, W. H. (Nichols Chemical Co.), *41 Cedar Street, New York.*
1892		Nolan, W. H., *Craig Street, Montreal.*
1893		Pearson, C. E. (Owner Mineral Lands), *Buckingham, Que.*
1891		*Penhale, John J. (United Asbestos Co., Ltd.), *Black Lake, Que.*
1893		Powell, W. F. (Mica Mine Owner), *47 Cooper Street, Ottawa.*
1891		*Prefontaine, R., Q.C., M.P. (Owner Mineral Lands), *Notre Dame Street, Montreal.*
1893		Rising, B. (Gresselli Chemical Co.), *Sherbrooke, Que.*
1891		*Sclater, Wm. (Owner Mineral Lands), *44 Foundling Street, Montreal.*
1893		Smith, Daniel (Hamilton Powder Co.), *Brownsburg, Que.*
1893		Smith, George R. (Bell's Asbestos Co), *Thetford Mines, Que.*
1891	×	*Smith, J. Burley, M.E. (British Phosphate Co.), *Glen Almond, Que.*
1893		Spafford, S. L. (Nichols Chemical Co.), *Capelton, Que.*
1891		*Stevenson, A. W., C.A. (Owner Mineral Lands), *17 St. John Street, Montreal.*
1891		*Stewart, George (Owner Phosphate Lands), *Buckingham, Que.*
1893		Symons, C. C. (Lake Girard Mica System), *Ironsides, Que.*
1893		Wadsworth, F., M.E. (American Gold Co.), *River Gilbert Gold Mines, Beauce County, Que.*
1893		Watters, Don C. (Lake Girard Mica System), *Besserer Street, Ottawa.*

Elected.	
1893	Wiley, F. A. (Owner Mineral Lands), *Port Arthur, Ont.*
1893	Williams, Capt. John J., *Sherbrooke, Que.*
1891	Williams, H. J. (Beaver Asbestos Co., Ltd.), *Thetford Mines, Que.*
1891	*Williams, Capt. T. W. (North Star Mine), *Buckingham, Que.*
1893	Woodward, J. R. (Dominion Lime Co.), *Sherbrooke, Que.*

OBITUARY.

Since the organization of the Association, the following members have been removed by death :—

1892—Dr. T. Sterry Hunt, New York.

1892—J. D. Ducharme, C. E., Montreal.

1893—W. Hall Irwin, "

GENERAL MINING ASSOCIATION OF THE PROVINCE OF QUEBEC.

Treasurer's Statement for Year Ending 13th January, 1892.

RECEIPTS.

Cash from 51 members' subscriptions at $10, as per statement appended	$510 00
	$510 00

DISBURSEMENTS.

Advertising, Engraving and Printing:		
Graham & Co	$ 7 80	
Gazette Printing and Publishing Co.	5 28	
Canadian Mining Review	2 00	
Becket Bros	1 75	
Typewriter	5 00	
Burland Litho. Co.	7 10	
Mortimer & Co.	20 80	
		$ 49 73
Dinner Expenses:		
Windsor Hotel	$ 30 50	
Burland Litho. Co.	9 00	
Carters	2 00	
Mortimer & Co.	10 00	
		$ 51 50
General Expenses:		
J. Hope, stenographer	$ 2 00	
Morton, Phillips & Co.	1 25	
B. T. A. Bell, Secretary, (including travelling expenses)	193 73	
Bank charges on cheques	3 50	
Postage	8 44	
Express charges	75	
Telegrams	30	
		$209 97
Balance in hands of Treasurer		198 80
		$510 00

(Signed) A. W. STEVENSON,
Treasurer.

STATEMENT

SHOWING

SUBSCRIPTIONS PAID TO TREASURER

DURING THE YEAR 1891-92.

R. Prefontaine, Q.C., M.P.	$10 00	F. H. Green	$10 00
E. Wertheim	10 00	L. A Klein	10 00
W. McIntosh	10 00	E. Hanson	10 00
J. Lavergne, M.P	10 00	Hon. Geo. Irvine, Q.C	10 00
J. B. Smith	10 00	Capt. R. C. Adams	10 00
W. J. Poupore, M.L.A	10 00	James King	10 00
S. P. Franchot	10 00	Col. Lucke	10 00
John Mooney	10 00	W. H. Irwin	10 00
R. T. Hopper	10 00	A. W. Stevenson	10 00
A. Lomer	10 00	W. A. Allan	10 00
Geo. Stewart	10 00	O. M. Harris	10 00
E. B. Haycock	10 00	John Blue	10 00
J. D. Ducharme	10 00	Capt Williams	10 00
F. D. Taylor	10 00	Charles Magee	10 00
Dickson Anderson	10 00	R. N. Hall, Q.C., M.P	10 00
W. Sclater	10 00	D. A. Brown	10 00
H. J. Williams	10 00	A. M. Evans	10 00
James Cooper	10 00	Capt. Bowie	10 00
Hector McRae	10 00	F. J. Falding	10 00
Thos. M. Williams	10 00	Dr. Killing	10 00
Hon. Geo. A. Drummond	10 00	J. Lainson Wills	10 00
F. A. Halsey	10 00	J. M. Jenckes	10 00
W. H. Jeffrey	10 00	S. H. Fleming	10 00
J. J. Penhale	10 00	B. T. A. Bell	10 00
W. T. Gibbs	10 00	W. P. Lockwood	10 00
Theo. Doucet	10 00		
			$510 00

GENERAL MINING ASSOCIATION OF THE PROVINCE OF QUEBEC.

Treasurer's Statement for Year Ending 13th January, 1893.

RECEIPTS.

To balance from 1891-2		$198 80
" Cash from 42 members' subscriptions, as per statement appended		420 00
		$618 80

DISBURSEMENTS.

Printing, Engraving and Stationery:		
Mortimer & Co.	$15 35	
Shareholder Pub. Co.	1 75	
		$ 17 10
Grant to Asbestos Club, as per resolution		50 00
Stenographing:		
Sills & Proctor.		12 50
Secretary's disbursements and travelling expenses		218 59
General Expenses:		
Windsor Hotel—balance dinner	86 15	
Collector's commission on subscriptions	2 00	
Telegrams.	29	
Commission on cheques	3 75	
Postage	9 85	
Carters and messengers.	2 15	
		$104 19
		$402 38
By balance in Treasurer's hands		216 42
		$618 80

(Signed) A. W. STEVENSON,
Treasurer.

STATEMENT

SHOWING

SUBSCRIPTIONS PAID TO TREASURER

DURING THE YEAR 1892-93.

R. T. Hopper	$10 00	W. H. Irwin	$10 00
Hon. G. Irvine, Q.C.	10 00	D. Anderson	10 00
D. A. Brown	10 00	John Blue	10 00
E. Hanson	10 00	Col. Lucke	10 00
F. F. Hunt	10 00	W. E. Bell	10 00
J. B. Smith	10 00	A. S. Johnson	10 00
W. H. Nolan	10 00	A. W. Stevenson	10 00
Hon. G. A Drummond	10 00	H. J. Jeffrey	10 00
W. A. Allan	10 00	John Mooney	10 00
F. A. Halsey	10 00	J. M. Jenckes	10 00
W. McIntosh	10 00	James King	10 00
A. M. Evans	10 00	James Cooper	10 00
O. M. Harris	10 00	Hector McRae	10 00
S. H. Fleming	10 00	Capt. Thos. Williams	10 00
Dr. Killing	10 00	Capt. Adams	10 00
F. Cirkel	10 00	J. L. Wills	10 00
R. Prefontaine, Q.C, M.P.	10 00	W. Sclater	10 00
E. B. Haycock	10 00	S. P. Franchot	10 00
L. A. Klein	10 00	E. Wertheim	10 00
E. W. Morgan	10 00	Theo. Doucet	10 00
J. J. Penhale	10 00	B. T. A. Bell	10 00
			$420 00

CONSTITUTION AND BY-LAWS.

As Amended at Quarterly General Meeting Held at Montreal, 7th April, 1893.

SECTION I.—**Name.**

1. The organization shall be called The General Mining Association of the Province of Quebec.

SECTION II.—**Object.**

2. The object of the Association will be to mutually benefit and protect its members by facilitating the interchange of knowledge and ideas, and by taking concerted action upon all matters affecting or relating to the mining industries of the Province of Quebec, and generally to promote the said industries by all lawful and honorable means.

SECTION III.—**Membership.**

3. The Association shall consist of Members, Associate and Honorary members.

4. Members shall be persons engaged in the direction and operation of mines and quarries in the Province of Quebec, more particularly mine and mill owners, parties interested in the ownership of mines, mining engineers, mine managers, superintendents and metallurgists.

5. Associate members shall be persons not eligible in the foregoing clause, but such persons whom the Association shall deem worthy of admission. All associates shall enjoy full privileges of membership.

6. Honorary members shall be persons eminent in the profession or history of the industry of the Province.

SECTION IV.—**Election of Members.**

7. A recommendation for admission according to Form "A" in the Appendix, shall be forwarded to the Secretary and by him laid before the Council, who shall have power to elect or reject by a majority vote. The recommendation shall be in writing and signed by not fewer than two members of the Association in good standing.

Section V.—Fees.

8. The membership fee shall be ten dollars, or such amount as may from time to time be determined by the Council, payable annually in advance at the Annual General Meeting of the Association, but any Member or Associate member being one year in arrear of his annual subscription shall cease to be a member.

Section VI.—Office Bearers.

9. The Office Bearers of the Association shall consist of: 1st, a President; 2nd, four Vice-Presidents; 3rd, a Secretary; 4th, a Treasurer; and nine Members in good standing, who shall act with the other Office Bearers as a general council.

10. The President shall be elected at the Annual Meeting by ballot, and shall not be eligible for re-election to a third consecutive term of office.

11. All past Presidents of the Association shall be elected Honorary Presidents.

Section VII.—Duties of Officers.

12. The President shall be Chairman at all meetings at which he shall be present, and in his absence one of the Vice-Presidents. In the absence of a Vice-President the members shall elect a Chairman for that meeting.

13. The Treasurer shall hold in trust the uninvested funds of the Association, which shall be deposited in the name of the Association at a bank approved by the Council; he shall receive all moneys and shall pay all accounts that are properly certified as correct by the Council, and shall present from time to time a statement of the Association's accounts.

14. The Secretary shall attend all meetings, shall take minutes of the proceedings, shall be responsible for the safe custody of all papers, books and other property of the Association, and, under the direction of the Council shall conduct the general business of the Association.

Section VIII.—Meetings.

15. The Annual General Meeting for the election of Office-Bearers, the transaction of the business of the Association and the reading and discussion of papers shall be held in the City of Montreal on the second Wednesday of January in each year.

16. General Meetings for the reading and discussion of papers and for the transaction of business, shall be held quarterly at such time and place as the Council may determine. Any special business or subject for discussion shall be specified in the notice convening such meetings, and the Secretary shall give not less than fourteen days' notice thereof to all members of the Association.

17. Extraordinary or urgent business may be transacted at any meeting, when considered absolutely necessary, by a three-quarter majority of those present.

18. Special meetings may be called by the President or a majority of the members of the Council at any time, notice of which, stating the nature of the business, shall be mailed by the Secretary to each member of the Association.

Section IX.—Consulting Officers.

19. The Council shall have power to appoint such consulting officers as may be thought desirable from time to time and may vote them suitable remuneration.

Section X.—Dissolution.

20. The Association shall not be broken up unless by the vote of two-thirds of the members present at any general meeting convened for the purpose of considering the dissolution, and after confirmation by a similar vote, at a subsequent meeting to be held not less than three or more than six months after the first—and notice of this last meeting shall be duly advertised as the Council or a General Meeting may advise.

Section XI.—Amendments to Constitution and By-Laws.

21. The foregoing Constitution and By-Laws may be amended by a two-thirds vote of any meeting, but notice of motion for such amendment must be given at least four weeks previous to the discussion of the same, of which notice the Secretary shall duly inform every member.

APPENDIX TO CONSTITUTION AND BY-LAWS.

FORM A.

Mr.....................being desirous of becoming a member of the General Mining Association of the Province of Quebec, we the undersigned, from our personal knowledge, do hereby recommend him for election.

.... } *Names of two Members.*
.... }

Date....................

FORM B.

SIR,—I beg to inform you that on the.....................you were elected a member of the General Mining Association of the Province of Quebec, but in conformity with the Constitution your election cannot be confirmed until the accompanying form be returned with your signature.

I am, Sir,
Your obedient servant,

....
General Secretary.

FORM C.

I, the undersigned, being elected a member of the General Mining Association of the Province of Quebec, do hereby agree that I will be governed by the regulations of the said Association, as they are now formed, or as they may be hereafter altered; that I will advance the interests of the Association as far as may be in my power; provided that, whenever I shall signify in writing to the Secretary that I am desirous of withdrawing my name therefrom I shall (after the payment of any arrears which may be due by me at that period) be free from this obligation.

(Signed) ....

....

Date....................

THE DUTY ON MINING MACHINERY.

Statement of Machinery Manufactured in Canada as Fyled in Department of Customs, 11th July, 1893.

Pursuant to resolution passed by the Association at its Quarterly Meeting, held at Sherbrooke, on 5th July, 1893, the following statement of the various classes and kinds of mining machinery, known to be made in Canada, was, after having been endorsed by the Mining Society of Nova Scotia, forwarded to the Hon. N. Clarke Wallace, Controller of Customs, Ottawa, who acknowledged it and the accompanying resolutions as under :—

OTTAWA, 14th July, 1893.

B. T. A. Bell, Esq.,
Secretary,
General Mining Association of the Province of Quebec,
Ottawa.

MY DEAR SIR,—I am in receipt of your letter of the 11th inst., re the importation of mining machinery, and note the terms of the resolution adopted by your Association respecting the tariff upon "machinery and appliances for mining, quarrying, smelting, concentrating, refining and treating ores and minerals of a class or kind not manufactured in Canada," and also in regard to steel rails exceeding 25 lbs. in weight. The views of your Association in respect of this matter shall have careful consideration when the tariff is under revision.

I note the statement attached as to the various classes of mining and quarrying machinery manufactured in Canada at the present time.

I am,
My Dear Sir,
Faithfully yours,
[Signed] N. CLARKE WALLACE.

MINING MACHINERY MADE IN CANADA.

—

Air Compressors.

KIND.	
Ingersoll-Sergeant	Ingersoll Rock Drill Co., Montreal.
Rand	Canadian Rand Drill Co., Sherbrooke.

Mine Pumps.

Northey Single	Northey Manufacturing Co., Toronto.
Northey Duplex Sinking Pumps	do do do
Smith Patent	Smith & Co., Toronto.
Polson Cornish Pumps	Polson Iron Co., Toronto.
Cornish Pumps—various	Different makers.

Prospecting Drills.

The "Diamond" Prospecting Drill	Jenckes Machine Co., Sherbrooke.

Rock Drills—Steam and Air.

Rand	Canadian Rand Drill Co., Montreal.
Ingersoll-Sergeant	Ingersoll Rock Drill Co., Montreal.

Rock and Ore Breakers.

Blake-Marsden	Jenckes Machine Co., Sherbrooke.
Blake	George Brush, Montreal.
Not known by any special name	Burrell Foundry and Machine Co., Yarmouth, and others.

Channellers, Quarry Bars, Gadders, etc.

Ingersoll Bar Channellers	Ingersoll Rock Drill Co., Montreal.
Ingersoll Gadders	do do do
Rand Channellers	Canadian Rand Drill Co., Sherbrooke.
Beatty Channellers and Quarry Bars	Beatty & Sons, Welland.
Own Make	Beckett Engine Co., Hamilton.

Coal Cutting Machines.

Sergeant Percussion Coal Cutters	Ingersoll Rock Drill Co., Montreal.
Harrison Patent Coal Drill	Canadian Rand Drill Co., Sherbrooke.

Coal and Mineral Conveyors and Elevating Machinery.

Link Belt	Truro Foundry and Machine Co., Truro.
Not known by any special name	Waterous Engine Co., Brantford.

Water Wheels for Gold, Slate, Phosphate and other Mineral Producing Mills.

New American	Kennedy & Sons, Owen Sound.
Little Giant	Paxton Tate & Co., Port Perry.
Girard	Canadian Rand Drill Co., Sherbrooke.
Vulcan	Paxton Tate & Co., Port Perry.

Gold and Silver Stamp Mills.

Nissen	Windsor Foundry and Machine Co., Windsor.
	Truro Foundry and Machine Co., Truro.
	Yarmouth Foundry and Machine Co., Yarmouth.
Not known by any special name	I. Matheson & Co., New Glasgow
	Woodside Bros., Port Arthur.
	G. & J. Brown Man'f'g. Co., Belleville.
	Jenckes Machine Co., Sherbrooke.

Hoisting, Winding and Hauling Engines.

	Ingersoll Rock Drill Co., Montreal.
	Jenckes Machine Co., Sherbrooke.
	Carriere, Laine & Co., Levis.
	Doty Engine Co., Toronto.
	Polson Iron Co., Toronto.
	A. R. Williams, Toronto.
Not known by any special name.	M. Beatty & Sons, Welland.
	G. & J. Brown Man'f'g. Co., Belleville.
	George Brush, Montreal.
	A. Fleck, Jr., Ottawa.
	Miller Bros. & Tom, Montreal.
	Killey Beckett Engine Co., Hamilton.
	Sherbrooke Iron Co., Sherbrooke.
	Macdougall & Sons, Montreal.
	Howell & Co., Halifax.
	Burrell, Johnson Machine Co., Yarmouth.
Not known by any special name.	Woodside Bros., Port Arthur.
	Truro Foundry and Machine Co., Truro.
	I. Matheson & Co., New Glesgow.
	Robb Engineering Co., Amherst.
	Waterous Engine Co., Brantford, and others

Smelting Furnaces and Equipment.

Herreschoff Water Jacket Smelting Furnace for Copper Ores	Jenckes Machine Co., Sherbrooke.
Eustis Water Jacket Furnace for Copper and other ores	Jenckes Machine Co., Sherbrooke,

Electric Motors, Pumps, Drills, Hoists and Electric Mining Machinery.

Edison and other patents .... Edison General Electric Co., Toronto.

Wire Rope Transmission and Tramway.

Rigid Cable Tramway and Hoisting gear.. George Low, Ottawa.
Lang's Patent .... Dominion Wire Rope Co., Montreal.
Not known by any special name. — B. Greening Co., Hamilton; Truro Foundry and Machine Co., Truro.

Ore Buckets.

Not known by any special name. — George Low, Ottawa. Jenckes Machine Co., Sherbrooke. Truro Foundry and Machine Co., Truro, and others.

(Signed) T. R. GUE,
Chairman of Com.
Mining Society of Nova Scotia.

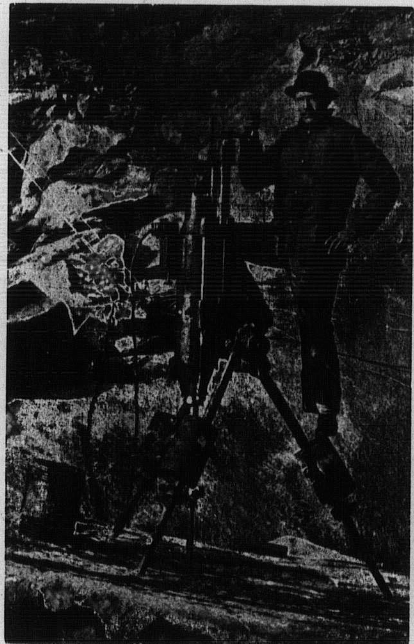
(Signed) JOHN E. HARDMAN.
Vice-President,
Mining Society of Nova Scotia.

(Signed) GEORGE IRVINE,
President,
General Mining Ass'n P. Que.

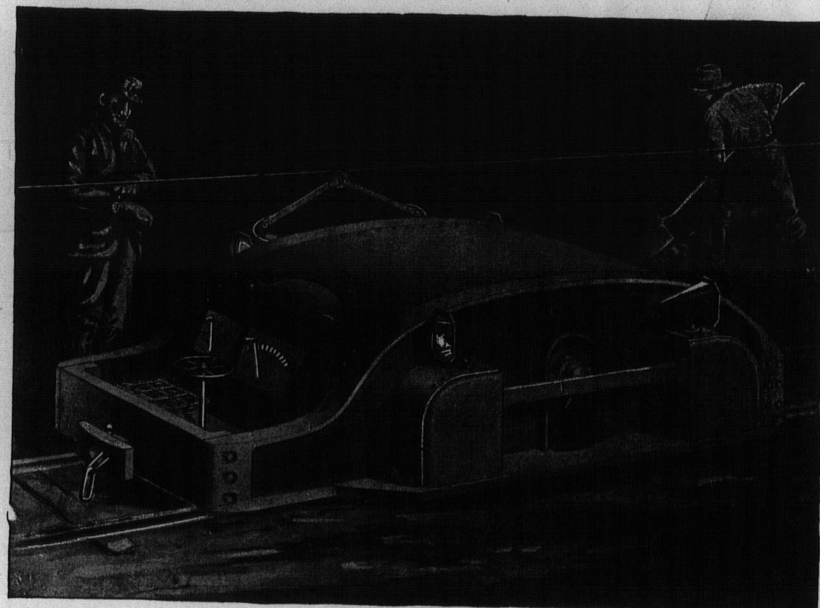
(Signed) B. T. A. BELL,
Secretary,
General Mining Ass'n P. Que.

GENERAL MINING ASSOCIATION OF QUEBEC.

PLATES I. and II.—Illustrating Mr. J. W. Kirkland's Paper on "Recent Developments in Electric Mining Apparatus."



Van Depoele Electric Drill.



Electric Mine Locomotive.

GENERAL MINING ASSOCIATION OF QUEBEC.

PLATE III.—Illustrating Mr. F. Cirkel's Paper on "The Occurrence of Asbestos at Templeton, Que."

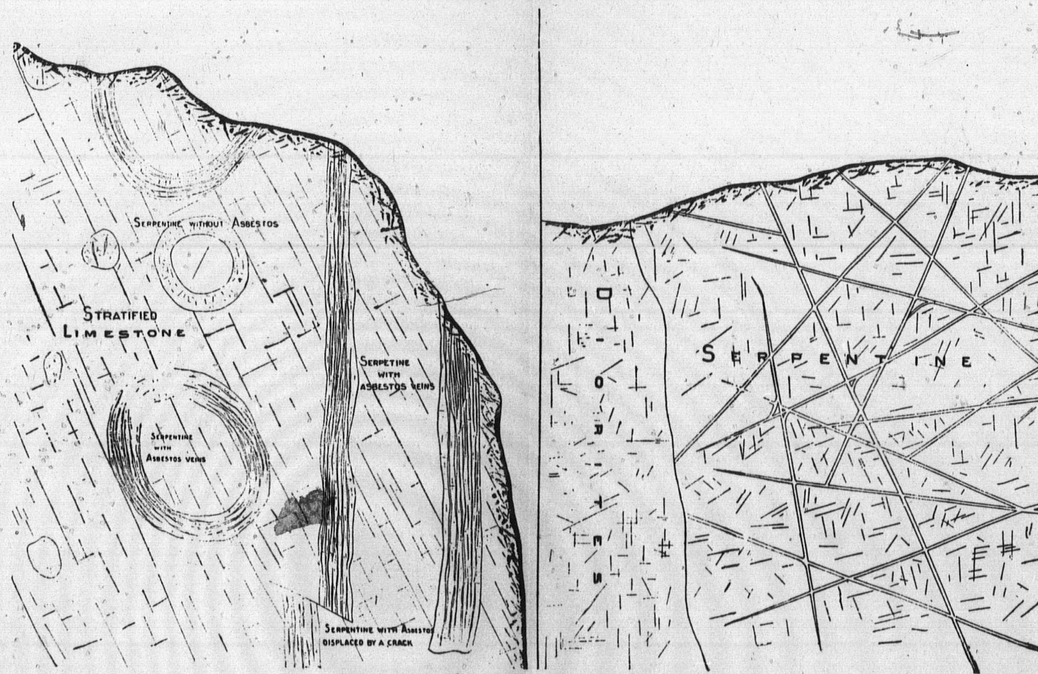
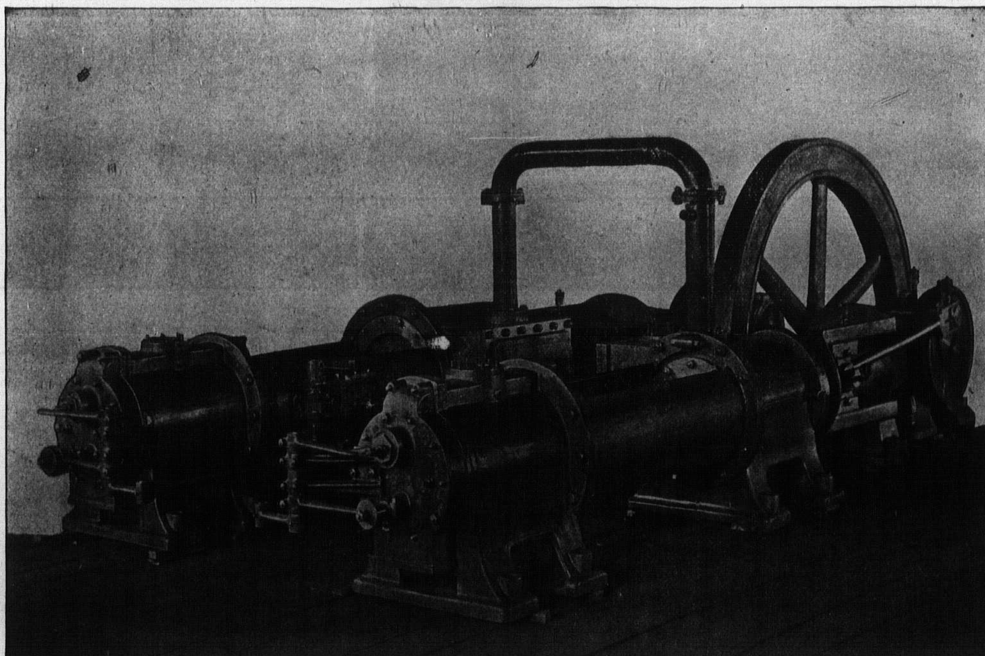
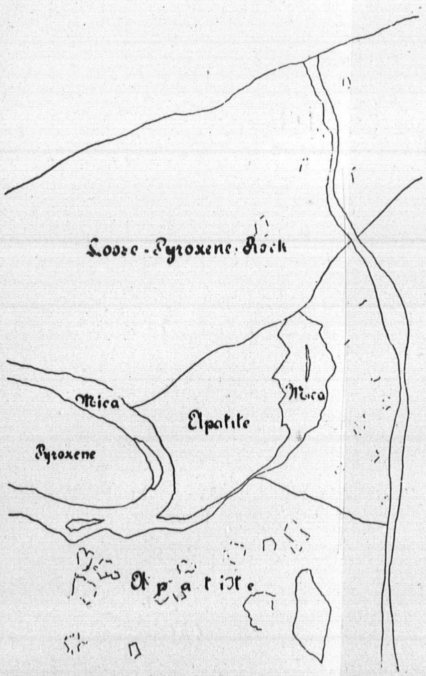


PLATE IV.—Illustrating Mr. F. A. Halsey's Paper on "Recent Practice in Economical Air Compressors."

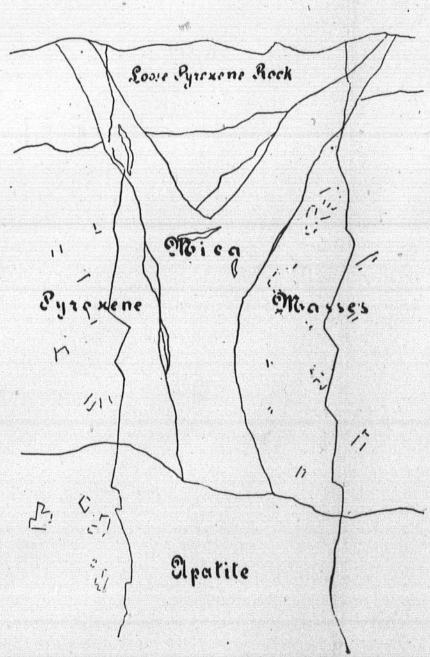


GENERAL MINING ASSOCIATION OF QUEBEC.

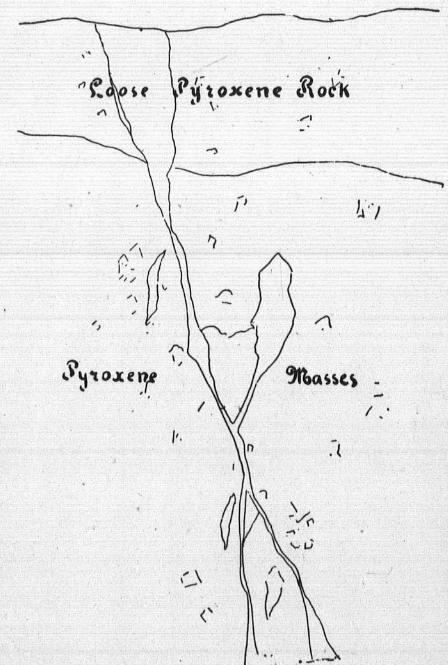
PLATE V.—Illustrating Paper by Mr. F. Cirkel, M.E., on "The Mica Deposits in Ottawa County."



Property of Mr. A. W. Stevenson, C.A., Montreal.



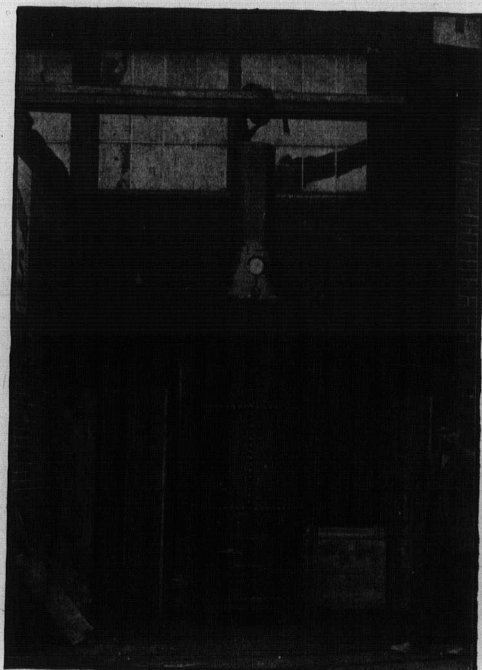
Property of the Templeton and North Ottawa Mining Co. (Lt.)



Property of Templeton Asbestos Mining Co. (Ltd.)

GENERAL MINING ASSOCIATION OF QUEBEC.

PLATES VI. and VII.—Illustrating Paper by Mr. Hector McRae, Ottawa, on "A New Sectional Boiler for Prospecting."



Kelly's Sectional Boiler.

In Sections ready for Transportation.

GENERAL MINING ASSOCIATION OF QUEBEC.

PLATE VIII.—Illustrating Paper by Mr. John Blue on "The Eustis Mine."

General View of the Surface Works of the Eustis Mining Co., at Capelton, Que.