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CANADIAN MINING & MECHANICAL REVIEW

CONDUCTED BY . . . . . B. T. A. BELL.

OFFICES:
Victoria Chambers, 140 Wellington Street,
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THE OFFICIAL ORGAN

—OF—

THE GOLD MINER'S ASSOCIATION OF NOVA SCOTIA,
THE UNITED MINING SOCIETY OF NOVA SCOTIA,
THE ASBESTOS CLUB, QUEBEC,
THE GENERL MINING SSOCIATION OF QU EBEC

THE following Resolutions of Council indicate beyond a peradventure the status of THE REVIEW as the exponent of the Canadian Mineral Industries:—

The Gold Miners' Association of Nova Scotia.

"At the annual meeting of the Gold Miners' Association of Nova Scotia, held at Halifax on 6th March, 1889, THE CANADIAN MINING REVIEW was adopted the official organ of this Association.

(Signed), B. C. WILSON, *President.*
G. J. PARTINGTON, *Secretary.*

The Mining Society of Nova Scotia.

"Moved by Mr. R. G. Leckie, seconded by Mr. C. A. Dimock, That the thanks of the Society be tendered to Mr. B. T. A. Bell for his kind offer placing the columns of THE REVIEW at the disposal of the Society; and that THE CANADIAN MINING REVIEW is hereby appointed the official organ of the Society."

(Signed), H. S. POOLE, *President,*
H. M. WYLDE, *Secretary.*

The Asbestos Club, (Quebec.)

"Resolved: That THE CANADIAN MINING REVIEW is, by authority of the Members and Council, hereby appointed the official organ of the Asbestos Club."

(Signed), D. A. BROWN, *President.*
A. M. EVANS, *Secretary.*

The General Mining Association of the Province of Quebec.

At a meeting of Council held at Montreal on Friday, 6th May, 1891, it was moved by Captain Adams, seconded by Mr. R. T. Hopper, and resolved: That THE CANADIAN MINING REVIEW be the official organ of the Association.

(Signed), GEORGE IRVINE, *President.*
B. T. A. BELL, *Secretary.*"

The Cape Breton Coal Syndicate.

Now that the political smoke which shrouded the birth of the Dominion Coal Company has begun to clear away, the general public may be interested in learning the plans of the promoters so far as they have been matured. Their scope may be most graphically understood by devoting a few lines to the state of affairs existing in the territory they have acquired. The General Mining Association having acquired the grant of all the ungranted mines and minerals in the Province of Nova Scotia, found on their arrival here that the best mines in Cape Breton and Pictou Counties were already granted and being worked. They acquired all the outstanding rights in these worked mines and inaugurated a monopoly. This was a veritable true blue monopoly, but at the same time a bonanza to the Nova Scotians. Wood was abundant, and coal in little demand, except at Halifax and in a few villages; but the large amount of money circulated by the Company gave employment to many workmen. The agitation which finally resulted in the cessation of the monopoly on terms mutually advantageous to the province and the Company, was partly personal, partly political, and largely that of the boomster. Upon the opening of the coal fields to the general public, a crowd of speculators rushed in and numerous mines were opened. The benefits which were promised from the breaking down of the barriers were however not realized with satisfactory promptitude. The sales of the General Mining Association in 1858, were 226,725 tons, and ten years later the added production of all the new mines made the total sales only 453,624 tons, and this during the years of free trade with the United States.

The rivalry which characterised the new companies in Cape Breton, inflicted heavy burdens, which some of them have carried to the present day. In Cow Bay were two expensive piers side by side. Two rival ports in Glace Bay. Two parallel railways from Glace Bay to Sydney, each with an independent pier, and so on. The poorer mines instead of being able to utilize the facilities of their wealthier neighbors, had to load vessels from scows, or to build wharves the sport of each succeeding winter. This competition existed outside the mines, and agents sacrificed coal, while an observant public laughed and got its fuel cheaply. The amount of money this competition has cost the Cape Breton mines runs into millions of dollars.

It is little wonder then that the shareholders of companies, representing without exception the most favored coal deposits of the continent of America, have been ready to retire from the barren honors of a system of fruitless competition.

It may be said here in justice to the shareholders of these companies that it is doubtful if they ever had clearly laid before them the benefits of a more or less complete consolidation of some of their operations, such as the management, transportation, sale, etc., of their product, or they would have taken some steps looking to reduction of costs, etc.

From a consideration of these very brief notes it will be apparent that so far as regards the mining operations, the Dominion Coal Company by consolidating these mines is fairly entitled to such profit as may accrue from regular and systematic system of mining, transportation, cet. In other parts of the world it is no uncommon thing to see a single company raising and selling annually a coal tonnage far in excess of what can be got from the Sydney coal field for some years to come. The abolition of the isolated staffs of managers, clerks, mechanical foremen, shipping agents, brokers, etc., attached to each colliery, and their replacement by a central source of control and supervision is alone no small item. The concentration of the transportation and shipment upon one peir in Sydney Harbor, provided with ample storage capacity to meet the gulf and local trade is a prerequisite. The continuation of such system of transportation to Louisburg will provide what has long been desired, a winter outlet. The importance of this is evident when the shipping season under the present trade conditions is scarcely seven months. Those who have had to struggle during a long winter in Cape Breton with the expense of keeping men and horses doing next to nothing, and maintaining pits in order, pumping, ventilating, etc., could best tell what a boon anything approaching steady work would prove.

The most noticeable point in this connection is the fact that the facilities for transporting coal by sea from the Cape Breton mines have unavoidably lagged behind the times. Steam transportation for the Gulf trade is imperative for many well known reasons, but the Cape Breton mines have hitherto been unable to fit themselves out properly for this important part of their business. Clearly no company hitherto operating in this field has had the resources to build proper coal-carrying steamers, consequently they have been obliged to employ a class of vessels, not the best suited for their peculiar requirements.

The new company should be provided with steamers adapted for speedy loading and unloading, capable of carrying large cargoes, and strong enough to tow one or more coal barges. In the case of the Gulf trade this will necessitate proper terminal facilities at Montreal, and an improvement upon the facilities at present provided at the other principal points of sale in the Gulf. These improvements in unloading steamers and loading cars, must be coupled with such lengthening of locks, etc., as will allow of coal carrying barges being taken west of Montreal. The difference in cost between the present system of transportation, and a business system such as is here outlined would astonish many people, and be equivalent to a carrying of Nova Scotia coal many miles west of any point reached by it at present.

Similar remarks apply to the transportation of coal from Louisburg to the United States, and there is no reason forbidding the construction of steamers carrying 8,000 tons per trip, and strong enough to take half as much more in tows. This leads to a largely increased output of the mines acquired by the Dominion Coal Company.

The present workings will require new arrangements and fresh machinery to enable them to greatly increase their output, and one or two new pits will have to be provided capable of delivering a couple of thousand tons each a day. The outlook therefore for the future in Cape Breton is decidedly encouraging; it is however likely that the coal trade of Cumberland and Pictou with Montreal will suffer at the hands of the new syndicate.

The success of this company in getting afloat, has incited a number of imitative schemes which have applied to the Local Legislature for Charters. Among them may be mentioned the Standard Coal Company, reported to be interested in coal areas in Port Hood, the Consolidated to operate in Cumberland county, and the Boston and Nova Scotia to operate at Broad Cove. The latter proposes to build a railway from Broad Cove to Orangedale on the Cape Breton Railway and to ship at the Strait of Canso or the mouth of the Inhabitants River. The cost of transportation of coal will somewhat

handicap the opertions, and the returns of the railway, some thirty miles long, from general traffic, will, judging from railway experience in Cape Breton during the past two years, not go far toward paying expenses.

Nickel Metallurgy.

Perhaps the most exhaustive as well as comprehensive and eminently practical treatise on Nickel and the progress in the metallurgy of this rare and precious metal, is to be found in a memoir recently published by a celebrated French engineer, Mons. David Levat, late Director General of the Society "Le Nickel," of Paris, France. This publication contains nearly one hundred pages of a report giving the mode of occurrence and methods of extracting the ore, and its roasting for the matte. It deals with the ores of nickel found in New Caledonia and in Canada. The first chapter has special reference to the New Caledonia ores; their origin, cost and mode of working, cobbing and washing; output of the quarries; transportation; treatment; fusion; reduction in Europe; and sums up also the ores of Canada, in the Sudbury district, giving their exact situation, mode of occurrence, composition and nature; poor outcrops; extraction of the ore in blocks as if from quarry; rich finds; underground work; transportation; calculations as to the revenue, etc.; roasting, the V method so-called; the fusion of roasted ores and the Herreshoff oven; the consumption of the metal; cost and revenue from reducing, etc.

The second chapter deals essentially with the metal as an alloy. Its reduction is discussed by the *dry method* and the separation of the iron, reduction in the reverbatory furnace and reducing furnace; also with the direct refining of the pigs. Then the chapter goes on to discuss the roasting of the reduced matte; the moulding and drying process in the oxyde of the ore; reduction in crucibles; in 'moufles'; in gas producing ovens; then the polishing-off process and the mercantile product itself.

Then there is a description of the *wet process*, the separating of the copper and the application of electrolytic reagents. The methods carried on at the works of Saint Denis. Impurities in the nickel often result from the wet method; these are also discussed whilst the Herrenschmidt process is described.

The third chapter deals with the metal in its pure state and the process of fusion for lamination. Properties of the metal are then discussed, how it can be tempered, nickel plating on iron, nickeling, polished nickel and flowing nickel. after which the Powell process is noted together with other new methods of treating nickel.

Then comes perhaps one of the most interesting sections of the report bearing on the alloys of nickel.

The first nickel alloy or combination of nickel with some other metal which M. Levat presents is nickel with copper—in which there is given a classified list of the various combinations of these two metals producing good results.

How Maillechort, Silverine, Argentan and other alloys are manufactured, their lamination and subsequent firing. The binary alloy (20 p.c. of nickel and 80 p.c. of copper) of copper and nickel is the one which is being adopted all over Europe for their new armour plates. The various properties of this alloy, offering enormous resistance and high tenacity, are noted, whilst the coefficient ductibility remains very high.

The manufacture of hearths for locomotives, of covers, nickel coins, French coins, coins from Mexico also receive a goodly share of notice.

The alliance or combination of nickel with iron and steel comes next. Their application in the case of plates for cruisers; experiments at Annapolis; experiments at Indian Head; the properties of nickel steel; the Mercadier method, and illustrations by Mr. J. Ritez are given and followed by experiments in traction, torsim, etc. The non-oxidizing influences and characters of these alloys is followed up by the available statistics on the output and production of nickel giving also the price of that metal, which is fast becoming so useful in the affairs of every day life throughout the world

Iron Mining in Ontario.

The man who attempts to write about iron mining in Ontario emulates that distinguished historian whose chapter on the snakes of Ireland consisted of the words, "there are no snakes in Ireland." Whether this statement holds true at the present time when there is a prospect of wigs on the green in the Emerald Isle, may be left to the friends of Mr. Gladstone's Home Rule Bill —or its enemies. But neither of these classes nor any other would deny the truth of the allegation that there is no iron mining in Ontario. The iron mines in this province may or may not rival Solomon's temple of old in point of richness, but they certainly resemble that edifice in the fact that they are strangers to any sound of hammer or tool. The stagnation is complete. There once was a fair amount of activity in the iron districts of Ontario when ore was raised and shipped to the United States markets, but the glowing prophecies made twenty-five or thirty years ago of the probable expansion of the iron mining business in this province contrast strongly with the pitiful performances of to-day. A collapse as complete as that which befel the workers on the tower of Babel has overtaken our iron mines, no one under existing conditions ventures to predict a genuine resumption of activity in any thing like the near future. Owners of caved-in shafts and holes in the ground filled with water may find some satisfaction in knowing that the ore is still on their property and that when the turn of the tide comes their long-deferred hopes of prosperity may stand some chance of fulfilment, but it is hard to live in hope, and to grow fat on it is simply impossible.

What is the cause of this state of affairs? Why is it that with abundant supplies of iron ore, ranging in quality from bad to best, but with plenty and to spare of all grades, with a population growing in wealth, increasing in output of manufactures and advancing in all departments of industrial activity, there was not a single ton of iron raised in Ontario last year? Why is it that there are no blast furnaces in the province? We have endless supplies of ore, mountains of limestone and forests of wood, yet every pound of iron that goes into the steam engines, agricultural implements, mill machinery and the thousand and one products of our foundries and machine shops is smelted beyond the boundaries of Ontario, and not one pound of it is from Ontario ore. We talk of the progress we are making in the arts of civilization and peace, but if our production of pig iron or even of iron ore be taken as the standard of judgment, we shall have to hide our diminished heads in shame. In the vast development which has characterized the business of iron manufacture in the United States, Great Britain and most other civilized countries during the closing half of the nineteenth century, it must be confessed that we have had but little share, and so far as the smelting of the ore itself is concerned, we have had no share at all. We have been content to refine the pig and re-melt the scrap of other lands, but have done nothing to add to the world's stock of the metal. We have not been backward in adopting the improvements and inventions which have been made in the domain of machinery and iron manufacturing generally, but so far as actual production of the metal itself is concerned, while the civilized world has been living in the iron age, we have been living in the stone age.

Comparing ourselves with our neighbors, we find that we are far outstripped by our copartners in the Confederation, small even as the total production of iron and iron ore in the Dominion is. Quebec in 1892 raised 28,090 net tons of ore and smelted into pig 36,540 tons, while Nova Scotia raised 75,000 tons; Ontario neither raised nor smelted any. In 1891 the total production in the Dominion of iron was 23,891 (net) tons, and of iron ore 68,979 tons, of which quantity Ontario contributed as her share a total of some 200 tons of iron ore. Contrast this with the 5,856,169 (long) tons of iron ore raised in Michigan in 1890, or the 6,127,101 tons mined there in 1891! The progress made in the iron mining industry in the State of Michigan is in truth something phenomenal, even in these days when advances in trade and commerce are made by leaps and bounds. In 1850, when Ontario was beginning to congratulate herself on the bright prospects ahead of her iron mines, the production of Michigan was only only 2,700 tons of ore, in 1891 it had risen, as stated above, to the enormous figure of 6,127,101 tons, while that of Ontario had dwindled to an amount scarcely visible to the naked eye. The marvellous development in the production of the iron mines of Lake Superior, in Michigan, Wisconsin and Minnesota, during the last ten

years may be seen on perusal of the following figures: in 1883 it was 2,352,840 (long) tons, in 1886, 3,559,371 tons; in 1889, 7,292,644 tons, and in 1892, 9,074,243 tons. In last year's production was included 4,245 tons from the Mesaba range in Minnesota, a new source of supply just beginning to be opened up, which promises to be as prolific as the Marquette, Menominee, Gogebic, or any of the older ranges. There is at present one mine, the Norrie, situated on the Gogebic range in Michigan, which is producing iron ore at the rate of about 1,000,000 tons per annum. Alabama increased her output of ore from 171,139 tons in 1880 to 1,570,319 tons in 1890, and 1,986,830 tons in 1891. Wisconsin produced 37,000 tons in 1880, and in 1890 the production had risen to 837,399 tons. Tennessee in 1880 produced 93,272 tons; in 1890, 473,294 tons, and in 1891, 543,923 tons. Pennsylvania, New York, New Jersey and other States, have long been heavy producers of iron ore, but the States named above have all (with the exception of Tennessee), begun the mining of iron ore in appreciable quantity at a date subsequent to the beginning of the business in Ontario, and all have left her hopelessly behind in the race. Alabama, which in 1872 produced 11,171 (long) tons of pig iron, in 1892 smelted 915,296 tons; Michigan in 1872 made 89,484 tons, and in 1892, 148,421 tons; Tennessee in 1872, 37,905 tons, and in 1892, 300,081 tons; and Wisconsin, in 1872, 58,092 tons, and in 1892, 114,961 tons. The total production of iron ore in the United States in 1890 was 14,518,857 tons, and of pig iron 9,202,702 tons, the latter in 1892 being a trifle less, viz., 9,157,000 tons. But further statistics of this sort are unnecessary. They but help to bring more unmistakably into notice the fact that while other portions of the North American continent have been making constant and very rapid progress in iron mining and iron making, here in the favored Province of Ontario in the year of grace 1892 we are forced to confess that not only is no progress being made, but that we are actually retrograding.

The courses which have led to this unsatisfactory condition of things are perhaps less important to know than the means to be adopted to remedy it, yet the latter can only be intelligently applied when the former are understood. No one who considers the situation with an unbiassed mind can do otherwise than come to the conclusion that in whatever way freer trade relations with the remainder of this continent would affect other industries and interests in Ontario it could have none but beneficial results upon iron mining. The close competition which the opening up of the new sources of supply within the past few years has given rise to in the United States markets has made it impossible to raise iron ore and ship it across the lines in face of a duty of 75 cents per ton, and the result is that the iron mines of central and eastern Ontario within easy distance of the great smelting centres in Ohio and Pennsylvania have been forced not only to cease raising ore to the surface but have even in some cases been obliged to keep on hand considerable quantities which had accumulated at the mouth of the mines when last in operation. Were commerce as free between Ontario and the United States as it is between Michigan and the rest of the Union, it is surely reasonable to suppose that results would ensure in Ontario similar to those which have followed in Michigan. Not only could iron ore be exported, which in itself would be a very great boon, but with a large outlet for charcoal iron, for the production of which the facilities possessed by Ontario are unequalled, the business of smelting would receive an impetus which could not be imparted to it in any other way. The Report of the Commission on the Mineral Resources of Ontario (1890) sums up this aspect of the situation very concisely in the following words: "The beneficial influence to be exerted upon the interests of the province by the stimulating effect certain to be the result of the breaking down of hostile tariffs between Canada and the United States would in the case of the export of iron ore, and probably of pig iron also, be certain to promote the prosperity of Ontario to an extent greater than any but the most sanguine would venture to predict."

But exporting iron ore to the United States against a duty of seventy-five cents a ton is an impossibility, and any trade re-arrangements with that country which would admit our ore free or at a low tariff are apparently doomed to remain in the clouds for some time yet. Is the iron business, then, to continue in its present state of deadly dullness, or is it out of the range of possibility to adopt some means within our own command to infuse life into it? Exporting iron ore being out of the question, obviously the only way in which a market for it can be provided is by establishing furnaces within the Province to smelt the ore at home. We have a population of over two millions which is a steady and large consumer of iron for all sorts of purposes, and the annual consumption will inevitably increase with the increase in our population. Nor is there anything which would tend more to the prosperity of the country, the development of its resources, or the general building up of its industries than the establishment of a healthy and successful business in the production of pig iron. All the labor employed in foreign countries in the mining of the ore, in taking it to market, in handling and smelting it at the furnace, is paid for in Canadian money when the pig iron is brought to the borders of our Province, and it takes the place of an equal amount of labor which might be employed at home were the iron produced here.

Up to the present time our energies as a people have been mainly directed to the development of agriculture, and the policy of our Provincial Government has been steadily directed to the encouragement of farming in every possible way. An agricultural college has been established and maintained at large expense, dairymen's and fruitgrowers' associations have received annually subventions from the Provincial treasury, travelling dairies perambulate the country at public expense teaching the youths and maidens of the land to make good butter instead of a corresponding quantity of axle grease, every township fair draws from the chest a grant to swell its prize list for fat pigs and log-cabin quilts, and no one grumbles at the cost. But surely agriculture is not everything. The miner draws the raw material from the bosom of mother earth and converts it to forms suitable for man's use just as truly as the farmer does, and his operations are attended as a rule with very much more expense and risk. On the other hand when his business is conducted in a large way the miner affords employment to labor on a scale with which the farmer, no matter how many acres he may work, cannot compare, and around his mine and furnaces there springs up a market of the very best kind for everything the farmer can produce. Every one knows that there is no better market for farm produce than a mining town. The honest farmer has been a favored guest at the Government table for, lo! these many years, and it would now seem in order if his mining brother were to get a share of the favors which have hitherto fallen almost exclusively to the agriculturist's lot.

There are indications, both many and strong, that the present time is an auspicious moment for the government of Ontario to reach out a helping hand to the iron industry. The conviction has become general that it is little short of a disgrace to the Province that she should be dependent upon foreign countries for her supply of iron when the raw material exists in such profusion within her own limits, and public spirited citizens ask what is better calculated to check the exodus and keep our young men at home than providing the means of employment which the mining, hauling, handling and smelting of iron ore would afford, to say nothing of the many related industries that would be its natural outgrowth. Smelting works once in operation would give a market for ores, and would naturally be followed by rolling mills, foundries, car wheel works, etc., to utilize and work up the pig iron produced. What has helped to build up Pittsburgh, Detroit, Cleveland, Buffalo, and many other cities across the line? Have these places not grown largely because they have become the seat of a thriving business in handling and smelting iron ore and pig iron? It is true that there is a much larger market across the line to absorb the output of the furnaces situated in these cities and elsewhere, but is there any reason to suppose that like results would not follow the establishing of furnaces here to supply our Ontario market? The Dominion government have placed a protective duty of $4 per ton on pig iron, and have added a bonus of $2 per ton on pig produced in the Dominion, now let the Ontario government grant some substantial assistance, and there can be little doubt that smelting furnaces will quickly rear their stacks in our province. Practical men and capitalists stand ready to risk their means in the venture if they can be assured of the government's en-

couragement and aid, either in the form of a bonus of say $2 per ton, the grant of an area of wooded land for charcoal purposes, the giving of a lump sum of money, or some such way. A bonus of so much per ton of output for a certain number of years would probably be the most suitable and satisfactory method of assistance, and it might be hoped that at the expiration of the term the business would have secured such a hold as to be able to stand alone.

There is another reason why the government may fairly be expected to come to the aid of the mining industry. By the new mining Act the government formally abandoned the policy of granting the minerals *in toto*, and now reserves a certain percentage of their value in the form of a royalty on the output. In this way the government practically declares itself a partner in all the mining ventures of the country, and it is contrary to all rules of partnership that the expense and risk should be wholly on one side. If a company is formed to work one or more of our neglected iron mines and to furnish the capital to establish and carry on blast furnaces, in view of the position assumed by the government in the new mining Act, and the immense public benefits which would flow from the erection of such works, it does not seem unreasonable that the public treasury should be called on to lend a helping hand.

Opinions may differ as to the respective advantages of coke and charcoal as fuel for furnaces in Ontario. In the United States by far the largest proportion of the output of pig iron is smelted by means of coke, the figures in 1892 being 75.2 per cent. coke iron, 18.97 per cent. anthracite iron, and 5.83 per cent. charcoal iron. While the actual quantity of charcoal iron produced in the United States does not now vary greatly from year to year (1892 the production was 532,365 tons) the increase has of late years been almost wholly in iron smelted by coke, so that the percentage of charcoal iron to the total output is much smaller now than formerly. The preference given to coke and coal by United States smelters is easily explained by the abundance of coal and the comparative and growing scarcity of wood suitable for making charcoal. In Ontario, however, a different state of things prevails. Here we have no coal and would require to import all our coke for smelting purposes, while in the immediate neighborhood of many of our ore deposits and within easy reach of almost any suitable site for a furnace are great stretches of land covered with wood adapted for making the best of charcoal. The cutting of this wood, the hauling of it to the kilns and the burning of it into charcoal would give employment to a large number of men and in this way the use of charcoal for smelting would ensure the expenditure of every dollar of money laid out for fuel among our farmers and backwoodsmen, instead of sending it to the States to purchase the product of the ovens and labor of Connellsville. This is a consideration which in granting assistance the Government would do well not to overlook, and it might be well to stipulate that the fuel used should be charcoal produced in our own province. There is also the advantage that charcoal iron brings a higher price than coke iron, and can be used in the manufacture of car-wheels and malleable castings, or wherever toughness and strength are essential, to great advantage. If charcoal furnaces were decided on, it would be necessary to erect them in proximity to supplies of wood as well as of ore in order to save haulage. There are localities in the iron districts of both eastern and western Ontario where wood and iron ore are found in large quantities close to each other, and in such places there will be no difficulty in finding good sites for all the furnaces likely to be put up. It would perhaps be found that a grant of land covered with hardwood would also be a very practical way of aiding in the erection of a charcoal iron furnace. In the Port Arthur district, again, there is an abundance of wood which, though not equal to the hard varieties, is yet capable of yielding a charcoal quite fit for the purpose of smelting iron, while the pig iron could be carried by water to many points at which it might be used, a consideration worth taking account of. On the other hand if it were determined that coke should be the fuel used, one obvious advantage would be to place the furnaces in such a position that while close enough to the supplies of ore they should not be obliged to pay unnecessary freight upon the coke. In this case possibly Toronto, Hamilton or Kingston might with advantage be selected as the site of the furnace or furnaces.

There need be no dubiety as to the quantity and quality of our Ontario ores. The hard magnetic ore which perhaps forms the bulk of the deposits of eastern Ontario, is similar in many respects to the magnetite from which the Swedes make the best charcoal iron in the world. There are enormous bodies of it, many of them contiguous to railway communication, which in some cases has been built largely for the purpose of promoting their development, and the means of transporting the ore already exist waiting to be taken advantage of. The excellent quality of many of these deposits has been proven by shipments made to the furnaces of the United States, and there is sufficient diversity in the nature and texture of the ores to give the mixtures desirable for many purposes in the furnace. Quantities of hematite are also known to exist, and more would probably be discovered were there a demand for this ore, as there doubt. ss would be in the event of furnaces being established.

The aid given to the iron industry should take a well defined form and should be guaranteed for a specified term of years. The investments which have hitherto been made in blast furnaces in Ontario have almost invariably resulted in total loss, and the record of failures is so unbroken that capitalists have apparently almost reached the conclusion that an adverse fate pursues the industry with relentless rigor. But if the history of the business be inquired into, it will be found that in the majority of cases iron smelting has been tried here by inexperienced men or men without the necessary means. Every mining district in America can show a list of failures perhaps as great as the iron sections of this province, yet the mistakes and misfortunes of pioneers have been the stepping stones on which their successors have risen to prosperity. The timidity of capital is proverbial, but with the natural advantages afforded by Ontario for the manufacture of pig iron reinforced by the protective tariff and bounty granted by the Dominion government, and a bonus of $2 per ton, which the Ontario government could well afford to give, there is every reason to believe that a prosperous smelting industry would in a short time be firmly established. The government of Sir Oliver Mowat has shown itself alive to the best interests of the province, and by its grants to railways and in aid of other enterprises has evinced a desire to promote the public prosperity in every way. There is a surplus of five or six millions in the treasury, a bonus of $2 per ton on pig iron would call for an expenditure of at most perhaps $75,000 or $100,000 a year, and the benefits which would result from the establishment of the industry would be such as to many times repay this outlay.

EN PASSANT.

Referring to the General Phosphate Corporation our London correspondent writes: "From what I hear there is a deadlock in this matter. The directors are willing to do something to help out the shareholders but not so much as is necessary, say £100 to £150,000, and the best opinion is that liquidation is inevitable. The Committee is still sitting, but as is natural, they have come somewhat to loggerheads with the official party. The early directors, on whose names so much of the money was subscribed, and who retired directly after, make a sort of virtue of this and say that they left the Company with ample and untouched capital, and they are not responsible for anything that happened since." This is a little like the muscular Quaker who objected to violence, but put an obtrusive burglar out of the window. He did him no harm and was not responsible for his hitting the ground somewhat hard. He left him alive and well 'just outside the window.'

Application has been made to the Lieutenant-Governor in Council for letters patent incorporating "The Talc Fibre Company of Frontenac and Hastings, Limited," with a capital of $150,000, for the purpose of working the talc deposits of Eastern Ontario. We understand that the company have secured nearly 2,000 acres of these deposits, and from the most scientific and practical tests, are convinced that the Canadian talc is fully equal in fibre-softness and floating qualities to any found in the United States, from which country, all talc used in the manufacture of paper in Canada, is imported. Arrangements have been completed for the erection of a mill at Kingston, for turning out the finished product, and it is believed that the talc will be placed on the market by the first of July. As Canada possesses almost fifty paper mills, all of which can use fibrous talc with profit to themselves, the new industry will commence business with an established market, and with every prospect of adding one more factor to the list, which means national development.

CORRESPONDENCE.

A Correction.

To the Editor of the Review:

SIR,—Your publication is usually so fair that I know you will be only too happy to correct an unjust inference which you seek to impose upon me in your February number.

With your general observations touching the relation of the Government of Nova Scotia to the recent coal mining syndicate I have no fault to find. They are in the main fair and very rational. But you step out of the way to discover an alleged inconsistency on my part—not a very serious one at worst—between utterances in January 1892 and January 1893.

Last year I was called upon to uphold the authority of the Nova Scotia legislature to increase the royalty on coal. In doing so I simply traced the history of the coal mining legislation of the province from the lease to the Duke of York (subsequently transferred to the General Mining Association), dated August 15th, 1826, for sixty years, to the present. That lease was honored until the date of its expiry, and no more royalty than 6d. per ton on round coal was ever attempted to be extracted until the full term had expired.

No one doubted that on and after August 15th, 1886, the Legislature of Nova Scotia had a right to increase the royalty. The only question at issue at all was whether the increase if made must not be made at the recurring periods of renewal. I was compelled, after due study and reflection, to advise the Government that no such limitation existed in respect either of the powers or rights of the Government, but that any time after August 15th, 1886, the legislature had unlimited powers to increase the royalty.

In my speech on the "Act for the further encouragement of coal mining," which recently passed the Nova Scotia Legislature, I never said one word inconsistent with the above. I did say that the existing leases of coal mines were irrevocable if the conditions were complied with and that they were practically for eighty years because renewal was compulsory. This is the gospel which we desire to preach as loudly and as widely as possible. But one of the terms of the existing leases says in plain words; "*Provided that the royalties may be increased, diminished or otherwise changed by the Legislature.*" The law requires that the Commissioner of Mines shall insert this explicit provision in every coal lease.

In January 1892, I was simply maintaining the power of the legislature to increase the royalty without in the slightest degree injuring the absolute validity and inviolability of the lease itself. In January 1893 I was simply upholding the validity and sacred character of the lease without impugning in the slightest degree the authority of the legislature to increase the royalty.

It may be urged by some that if the legislature has the right to increase the royalty, this power might be exercised in such a way as to lessen the value of the lease. That is possible, and, therefore, the Government of Nova Scotia have always been ready to give to existing lease holders a lease fixing a maximum royalty, which should never be exceeded during the entire term. The lease which has been recently authorized by the legislature, and which Mr. Whitney and his associates will likely take, is not a new conception; but the coal owners of Nova Scotia have long been aware that the permanent character of the royalty charge was always available for them if they particularly desired it.

But this much I must add, that notwithstanding the fact that the right to increase the royalty undoubtedly exists now in Nova Scotia, yet it is absolutely safe to rely that this power will never be exercised in an arbitrary spirit. Public opinion would never sanction the charging of any greater royalty than the industry could fairly bear. When the increase was made last year, no reasonable man will say that the coal trade could not infinitely more easily bear a royalty of 10 cents per ton, than it could bear 7½ cents per ton during the ten or twenty years preceding. The fact was that all well conducted companies were declaring handsome dividends in 1892 where they had barely been able to exist a few years previously. The fact that the coal mining industry can bear a royalty of 10 cents per ton is abundantly demonstrated by the fact that Mr. Whitney, whose sole object, I take it, is to make money by mining coal, voluntarily agrees to pay 12½ cents per ton royalty.

Of one thing always rest assured, the legislature—that is the people of Nova Scotia—will always keep rigid faith with all persons and bodies with which it has obligations or relations of any kind.

Yours, etc.,

J. W. LONGLEY.

Halifax, Feb. 14, 1893.

Purchase of the Walker-Carter Process.

To the Editor of the Review:

SIR—I learn from the best authority that the Walker-Carter process for treating gold-bearing refractory ores, which is now in successful operation at Marmora, Ont., has been purchased for Canada by Mr. Arthur Kitson of this city, who proposes to build a factory at New Toronto this summer, and commence the manufacture of the machinery pertaining thereto. The process has proven an immense success with the Hastings County ores. I learn this privately, but from undisputed authority.

W. J. MCLEAN.

Mutual Bay, Phila., April 24, 1893.

The Nova Scotia Mines Report for 1892.

To the Editor of the Review:

SIR,—Perhaps you may find space for the following curiosities, culled at random from the recently issued Mines Report for this Province:—

The report is dated Feby. 14th, 1893, and yet speaks for the year ending December 31st, 1892, at which latter date the year 1892 was completed and ended.

On page 12, it is mentioned: The coal in Scott pit tunnel was fired by a roburite shot on the 8th December. On page 13 the same occurrence is said to have happened on the 7th December.

Page 13.—"All the above shots were fired by electric batteries, and in mines where there is much dust I consider it safer than ordinary powder, but it is not an absolute safe process where there is gas."

Page 14.—Five times is the name of a certain pit given as Ford, and Five times as Foord.

Page 23.—"Since, a lower level has been driven and used for drainage and return airway, making a remarkable (sic) improvement. * * A hot well has been sunk."

Page 24.—"There have been no new feature of work in this mine during the year. * * Rooms have also been opened up there, at the time of driving those deeps and levels. * * An Ingersoll air compressor has been added to the plant driving three coal cutting machines, on in the east deep distance from engine 1,410 feet, two inches, the west deep 2,900 feet, they are giving good satisfaction."

The same locality is called in different parts of the Report, Caribou, Carabou and Carribou.

Page 25 says.—"A new pump *were* placed in the new deeps."

Page 26.—"A new pump has been placed in the drift, size 30 inches, stroke 9 inches, water 14 inches, steam cylinder. * * The engine is placed in the pit to the rise of the shaft bottom, and hauls the coal up the deep, and it is there let back to the pit bottom. * * As no reports of a workable seam *has* been made."

Page 32.—"His ideas which appear perfectly plain and practicable would I think if acted upon and carried out, be efficient and considerable saving to the company. * * The Copeland mine is down 100 feet. *They* have a fifteen stamp mill. * * The North Star Co. * * were down at date of visit, 400 feet, on an angle of from 20° to 30° south. There is also a westerley dip, caused by a roll in the measures."

Page 33 calls Harrigan Rock, Hurricane Cove; and spells Mr. Reid's name "Reade."

Page 34.—"A large water tank was placed about 20 feet down the shaft, and all the water from surface is caught in, thus leaving the mine," etc.

It is gratifying to be told on page 35: "There are also several groups of men prospecting around. The roads being largely improved during the past 2 years gives men an opportunity to move around and prospect the country."

Credit is not given to the source whence was taken the abstract of the Austrian Fire-damp Commission. Valuable undoubtedly, but in parts not thoroughly cooked *e.g.*, page 44 says "[illegible]3 down limits of percentages of gas for the three lamps above, which trying for gas may be dangerous." To digest this information it is necessary to know what they are, and this is lacking.

Page 53, Wentworth Creek? This quarry is in Windsor. It is a white calcining plaster.

Page 55, gives the value of limestone at North Sydney, as $2.08 per barrel, a manifest error.

On comparing this report with that for 1891, we miss the "statement of the number of classes of men employed etc;" data for this table is required of the mines and if it is not to be used, for what purpose is it asked?

On comparing it with report of still older date, we find omitted "the financial statements" "the colliery construction account," for which table data are required in the returns from the several mines.

Then we miss the "mineral leases" [other than gold] a most important table.

On going still further back in the Reports of the Department, we find "annual summaries" from each Gold District, which if it is not published every year, might well be occasionally

Yours etc.,

DONALD MACTAVISH.

Halifax, 30 April, 1892.

The Preservation of our Forests.

To the Editor of the Review:

SIR,—With reference to the resolution adopted by the recent mining convention at Montreal urging the Provincial and Dominion Governments to more rigorous and vigorous efforts for the protection of forests, the following facts are emphatic:

1. The area of timber limits in Quebec and Ontario sold since 1870 is approximately 10,000 square miles. "Fire follows the lumberman" partially for the reason that the settler follows the lumberman. The free grant system has so thoroughly swept out areas in Ontario that the fact is undeniable that the settler is reckless in the use of fire for clearing his land. He burns his own soil and his neighbors timber. The Crown Lands reports and the report of the Mining Commission call for interference against this member of the community.

2. The parties injured will not prosecute. I have known a large part of a township set on fire by a young fellow who wanted to clear up some land in August—a very dry season. It was impossible to get anyone to move in the matter, although the grumbling was loud and deep. There is no remedy—absolutely none whatever—under a suit for damages, (1) because the homestead law protects the settlers' land from execution; (2) because the Exemption Act practically protects all his few chattels. The fire rangers will not prosecute. There has only been one prosecution attempted by the province (government) of Ontario, and that I believe was settled.

3. Until the people are educated by stringent legislation, committed to public prosecutors to enforce, there will be no change in the present condition of affairs. As a matter of fact the license of occupation given to a free grant settler, is a license to burn up all the timber within reach of the effects of his blazing log-heaps. The Government says the settler must do so and so. The settler does as he pleases.

4. A practical remedy will be (1) to give or rather to require magistrates, on the complaint of any person or on any requisition, to institute an enquiry into the facts as to the origin of any forest fire, with power to send for witnesses and examine them, and to report the testimony to the County Crown Attorney whose duty it shall be to advise the Crown whether the evidence warrants an indictment for criminal negligence and arson. (2) A more active remedy, which would be automatic so to speak, would be to resort to the old English law which gave the injured party redress in damages arising from loss by fire, by assessing the loss on the township. This would make every ratepayer a fire guardian and an insurer at the same time.

To show the loss going on, I would cite the townships Hinchinbrooke and Bedford near Kingston, as one of several hundred illustrations which might be adduced: I own with some friends a tract of 1,500 acres, which today has not 150 cords of wood on it. Twenty years ago it was well timbered. A party of picknicking berry-pickers set fire to it one year; surrounding settlers the next; and in three or four years timber of the value of $15,000 was swept away. The land is worthless except as a mining tract. Hinchinbrooke which was the finest timbered township in eastern Ontario, has been swept by settlers' fires of timber worth ten times the utmost possible value of all the agricultural improvements which by any possibility can be attained by the settlement of this township. A careful estimate, township by township, throughout Ontario would show an aggregate loss—to which every year additions are being made—of probably $200,000,000.

Yours, etc.,

J. BAWDEN.

Kingston, Ont., 30th April, 1892.

A Peep at the Future of the Coal Trade by a Follower of the Black Art.

To the Editor of the Review:

SIR,—Do not be startled if I flash the mirror of fate before your eyes for a moment. Recent movements of an under-earthly character have so disturbed the workers in darkness, whose aim nevertheless is light; such fearful pictures have been sketched; Old Probability has been so drawn upon that his coffers of "likelies" are almost exhausted and imagination flickers with the weakening pulsation that precedes the offensive odour when light ends in smoke. All these have so disturbed my pursuit of the black art; I am so begrimed with the dust of coaly matter; my sight is so bedimmed by its quaquaversal movement, that....there! the mirror is turned, my distracted mind is relieved; and now it is turned again. And what have I seen? First of all that caught my eye were the words—not "abracadabra" or horrificabilimalitudinetatibusque"—but the plain unmistakeable words—nineteen hundred and thirteen. They were set in a dense haze which did not, however, affect or diminish their brilliancy. They seemed rather to have come out of this dark envelope, as if it represented the present intermédium of doubt, uncertainty and dread; and they had rushed to the front to put a good face on it. Nineteen hundred and thirteen, I muttered to myself, and as I repeated the words, the representation of them gradually assumed the shape of a hand with a beckoning finger. I followed, in Asmodeus fashion, clinging to the tip of the finger, and was set down on the edge of a cliff against which a mighty, boundless ocean dashed its endless waves. Noiseless they burst against the opposing rock, no crash of watery volume, no whish of broken force reached my ear: it was filled with a noise of the like of which I have no experience. There seemed to be a mingling of the clatter of the machinery of a cotton factory with the clinching, deafening thuds of a boiler shop or an iron-ship-building yard; and, now and then, as if striving for the mastery, a rattle as of tons of pebbles dropped from some altitude on an iron floor.

Amazed and astounded I looked round for the cause of this extraordinary din. The sky was clear, cloudless, no jar of the elements seemed present. As I gazed I noticed that the horizon was shut out from sight by huge erections

in front and on each side of me. Intermingled with these was a large number of moving structures of like form, but less stature; they were floating vessels, and were passing into and from the ocean with steadiness, in rotation of the ebb and flow of the tide.

Directing my steps towards one of these peculiar looking buildings, I gazed on a sight that struck me with astonishment. From the top of a tall structure of iron, which was placed over a coal mine shaft, I saw, issuing with an unceasing movement, huge masses of coal with a steadiness of motion akin to that of a column of water, passing into an iron box or shoot leaning at an acute angle into the top of a large iron tube on the deck of the vessels.

The shaft tube had openings in it like windows, in alternate position, from near the bottom of the tube to the top, out of which clouds of dust came flying, and showers of slack coal falling on the outside of the tube. While I stood in admiration of this wonderful operation, I observed a vessel leaving the position in which it had taken a cargo of coal. Nothing was perceptible of the means of motion; no smoke funnel was to be seen; no masts; and, adding wonder to wonder, I saw the tube through which the coal had passed into the vessel disappear in telescopic fashion and present only a short projection above the deck.

I was bewildered: surely I was dreaming: this was an impossibility in 1893; how is it done in 1913?

An intelligent looking man was passing; I spoke to him; he courteously exchanged remarks on the weather and I soon interested him in my curiosity.

The flow of the coal from the top of the shaft tube into the vessel was quite intelligible, but how was the coal sent up from the bottom of the shaft? Forced up, he replied. Forced up by what means? I inquired. Why, sir, in piston fashion. But by what motive power? Electric was the answer. Electric how obtained? By insulating a large extent of the mine and thus accumulating a reservoir of productive power, like a steam boiler, and applying it as I have likened the action. Wonderful! wonderful! I uttered; but tell me, how is the supply of coal obtained in such flowing quantity in the mine? By electric machines, he answered. There are three in operation at once: two with a horizontal action, one of which cuts along the top of the seam, the other cuts the bottom; and the third machine has a vertical action and cuts along the back of the horizontal severances and thus completely separates a large mass of coal. An electric ram or buttor, as it is called, shoves the entire mass over the roadway where it breaks and falls into large boxes and is hauled by electric motors to the shaft, there it is dumped into the elevator and is shoved up as you have seen. You noticed the vessels, I suppose, he added. Yes, I replied; they too seem to be of a mysterious character. Not more so than the mine operations he answered. But where is their motive power obtained? Electric sir, electric. That may be, but how started? what sets the motors agoing? Bottled power, sir, enough and to spare is stored in a condensed form to last the voyage. And do these vessels perform the trips with regularity? Oh! yes, they come and go at fixed periods. But surely the weather must often disconcert this regularity? Oh! no, not at all, they have a gas-generating apparatus on board, and another for converting the gas into oil which is lavishly poured on the water when a gale springs up; and thus they glide along steadily, unimpeded, and maintain the regularity I have named. When they reach the port of discharge, he continued, the loading tube is raised aloft, a connecting tube or spout is attached to the top thereof, a like action to that in the coal shaft is set to work in the vessel and the cargo is dumped into the coal yard at a rate of discharge equal to that with which it was taken in. I was amazed, nay dumbfoundered. I must be dreaming. This is all bosh, my friend, I exclaimed. Not so, he said. Well, but tell me, where does all this coal go to? To all parts of the earth, he replied. And in what part of the earth am I now, I asked! In Cape Breton.

R. V. WINKLE.

Sydney, 1st April, 1893.

MINING NOTES.

[FROM OUR OWN CORRESPONDENTS.]

Ontario.

Kingston District.

It is probable that active mining operations will soon be developed in the townships of Barrie and Clarendon, county Frontenac. Veins carrying mispickel, antimony, copper, lead and silver, have been opened on lots 10 to 14 in the 8th concession of Barrie. Pocket specimens passed to college professors for analyses have shown the usual astonishing results obtained from selected samples. There seems to be no doubt, however, that the find is a remarkable one. If the Ontario Government wishes to make its Bureau of Mines something more than an annex of the Crown Lands Department, an expert with a diamond drill will be sent into this township and also into Clarendon, Tudor and Bedford for the purpose of showing to the world the permanence or otherwise of the galeniferous deposits of this region. The Geological Survey might also lend a hand in the investigation of this district. The work begun by the late H. G. Vennor is very incomplete, and much remains to be done to give the enquiring minds of investors and miners any adequate notion of the stratigraphy of the district. If an effort is made to take advantage of the prospecting which always follows discovery in a new district, there may be laid the foundation of an important mining industry, but if the aloofness of the Departments creates the impression abroad "that there is nothing in it," the prospectors labors will be in vain, and the usual Canadian torpidity will ensue which nothing short of a bonus or bounty will remove. There is an opportunity at hand for either Governments, or both, to show willingness and capability to aid in the promotion of mining enterprise.

Perth District.

Capt. Robert C. Adams, of Montreal, and some New York friends have purchased from the Anglo-Canadian Phosphate Co., Ltd., the Otty Lake mines at North Burgess, Ont., and on 1st May will begin mining for mica. The property contains some three thousand acres, is equipped with a good working plant and is situate a few miles from the town of Perth. It has been extensively worked by the old company for phosphate. We heartily wish the genial captain success in his new venture.

Quebec.

Ottawa County.

The Blackburn phosphate mines in Templeton were closed down on the 1st of April, and the men all paid off. The property has reverted from the English company, who operated it under agreement, to Mr. Robert Blackburn, Ottawa, the former owner.

Several seizures were made on Lee Brothers mining tools (mica and phosphate) on Lot 4 in 9th Range, and 18 in 10th of Templeton. Eighty-five tons of 80% and twenty-five tons of 70% phosphate sold for $350; the mining tools and three tons mica for $45. Fifty-three barrels of rough split mica at the Templeton station were bought in by Rochon & Champagne, the Hull notaries, for $300; and twenty-five tons rough mica were purchased by McRae & Co., for $100. All the claims, with the exception of about $150, have been satisfied. The Hull lawyers got quite the best of it.

The Lake Girard Mica System are rushing work on the Murphy and Charette mica lots. About 40 men will be employed.

George and John Wallingford are opening up Lot 16 in 9th, with seven men. About 8 tons mica have been extracted during April.

Messrs. Powell and Clemow have resumed work on the Godson lot with 10 men.

Mr. Lewis McLaurin has commenced working mica on the McLaurin property, employing a small force.

McRae & Co. are working the Allan and Fleming, Lot 28, in 4th Range of Wakefield, for mica. E. K. Roche is superintending operations with 12 men. This property is opening up well.

Capt. Adams' Lot 10, in 2nd Range, Portland West, has been bonded to McRae & Co., Ottawa. Tom Lyons, late superintendent of Canadian Phosphate Co., is opening up the claim for mica with 10 men.

The Lake Girard, Nellie and Blanche, and Perth mica mines, are turning out usual amount of material for the System.

Mica exports from Ottawa for April were a little over $6,000.

Messrs. Jamieson and Wright are rushing things at the Cassidy mine, and are turning out the biggest sized mica in the country.

Messrs. Brennan and Dowler are opening up Lot 23 on 2nd Range of Portland West. Archy Woodhouse is foreman with 10 men under him.

Messrs. Nellis and Gemmill have abandoned the big pit at the Gow mine and are working on the surface again. About 150 tons mica stored ready for cutting. It is generally understood that the firm intend putting up a cutting house near the mine—the machinery having recently been purchased in New York.

The High Rock Mine is turning out better this season than ever before. Immediately behind the Compressor House on the hill, an immense show of phosphate was opened up three or four months ago, which keeps on improving as work progresses.

Mr. J. Burley Smith, (British Phosphate Co.) has about 4,000 tons of 60, 65, and 80 per cent. phosphate ready for shipment this season. Mining operations will likely be suspended soon, and extensive diamond drill tests will be made in order to locate the big bunches.

Messrs. Poulton and Lamb, who have been working mica and phosphate on Battle Lake for the past six months, have closed down for a time owing to the illness of Mr. Poulton. About 20 tons mica and 60 tons phosphate were mined during the first four months.

The Kootenay and Columbia Prospecting and Mining Company have had a second Kelly Sectional Boiler built at Messrs. Powers & Co., for the Stanley mine, Kaslo, B.C. A carload of machinery and mining outfit leaves Ottawa about the middle of May. Ten miners under charge of James Kelly will leave for the Slocan about the 10th of May.

Quite a number of prospectors are at work looking for mica in the rear part of the Township of Hastings. Some fairly good shows are being developed. Messrs. Smith and Lacey are working their old white mica property in that district.

Saguenay District.

Messrs. G. B. Hall and Daniel McGill have been making considerable shipments of white mica to New York and Boston from their property opened up last fall in the Saguenay district. About 2000 lbs. of cut sizes from 2½x3 to 7x9 have been sold this month.

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 washiers 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.

*Paper read before the April meeting of the General Mining Association of Quebec.

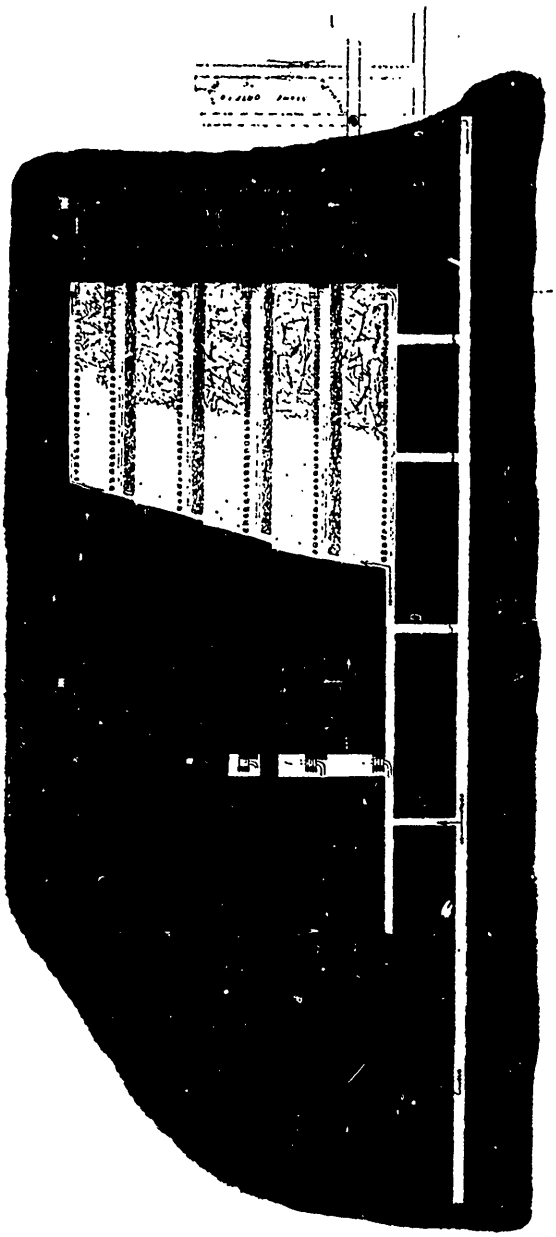


FIG 1.—PLAN OF LONGWALL LITTLE SEAM, ALBION MINES, PICTOU CO.

MODIFICATION OF WORKING COAL IN NOVA SCOTIA.

Plate I.—Illustrating Mr. J. G. Rutherford's Paper.

Doors are shewn thus D; brick stoppings thus, =; canvas doors and stoppings thus, |; white arrows show air current in deep seam; black arrows show air current in little seam.

MODIFICATION OF WORKING COAL

Lately Introduced in Nova Scotia.

[Being a series of papers contributed to the *Transactions* of the Mining Society of Nova Scotia.]

[1] Pictou County.

By Mr. J. G. Rutherford, B.A., M.E., Stellarton.

The method of getting coal by Longwall is not entirely new in Pictou County. Some old crop workings on the deep seam were operated on this system previous to the year 1828, and in 1860 a small area of the oil-coal or Stellar seam was worked in a similar manner by the late Mr. Henry Poole; but the practice has almost generally obtained of working by the bord and pillar method, by which from 30 to 40 per cent. of the seam is got on first workings. In some noteworthy cases this forewinning has been rapidly and successfully followed by pillar drawings or as termed in the north of England "working the broken"; in others, this inherent principle of working by bord and pillar has been lost sight of or voluntarily ignored.

The main or highest workable seam—some 30 or 40 feet thick—of the Albion series, has been extensively worked on the latter system, and much of the coal left primarily in pillars has been subsequently extracted. To the dip, however, a large area of workings exist in which no pillars have been robbed. The deep or cage pit seam which underlies the main, separated by about 156 feet of measures principally brown shale, has also to a considerable extent been worked on the same system, and a small proportion of the rise pillars were successfully withdrawn, but evidence of a gob-fire existing having been observed, the district was speedily abandoned and built off from the rest of the mine.

When the workings on these two valuable seams were temporarily rendered unproductive by the explosion in the Foord Pit in 1880, and the subsequent firing of both seams, attention was at once directed to the immediately underlying seams—hitherto unwrought—viz.: the 3rd and McGregor. Crop openings were made and the work laid out on the bord and pillar method. The main slope of the 3rd seam is now down a distance of 1880 feet from the entrance, and the vertical depth of the lowest level is 700 and odd feet. From this point a pair of stone drifts or tunnels were set away with a slight rise across the measures, which would enter the overlying deep seam at a point below the lowest of the old workings of the Cage Pit. After passing through very hard strata the seam was penetrated at a distance of 219 feet and presented the following section taken vertically to the place of stratification.

Thill or pavement—Brown shale.

	Feet.	Inches.
COAL (good).....	3	10
Coarse coal and shale.....	8	7
Shale with ironstone nodules.....		11
Coarse coal.....	3	10
COAL (good).....	13	4
Coarse coal with ironstone bands.	3	6
COAL (good).....	4	3

For the purposes of this paper, the names applied locally to the different divisions of the seam will be adopted, and hereafter the main or 13 ft. 4 in. portion will be known as the Deep seam, and the highest or 4 ft 3 in. part as the Little or 4 ft. seam.

The Deep seam having been worked to some extent a few years ago, its character is pretty well known; but with the exception of a small pair of dip slants for drainage purposes, the Little seam, in which the recently adopted longwall work is carried on, had not hitherto been worked. It may be well then to describe it. As shewn in the section it is 4 ft. 3 in. thick, and is a clean, bright coal from roof to pavement. There is a variable amount, generally 12 to 14 inches, of excellent cannel next the floor. Proceeding in an easterly direction the cannel is gradually replaced by coal similar to the upper part of the seam, but more lustrous and of a freer nature. The cleat is well defined and at right angles to the bedding plane. It bears about 10 degrees east of full dip; the latter being N 45° E, at an angle of 20° to 21° increasing in a westerly direction and growing lighter towards the east. The seam is traversed by a system of parallel joints, bearing about 29 degrees east of the dip and seldom farther apart than a yard, frequently as close together as six inches. These joints do not extend upwards beyond the coal, but are observed in the pavement and underlying Deep seam. They hade with the dip of the seam at a light angle. While lypes or backs are frequent in the Deep seam, running in every direction, they are seldom met with in the Little seam.

Method of Working—When the Deep seam was reached a main or haulage level 9 ft. by 8 ft. high was turned away right and left or in an easterly and westerly direction. Rise headings were put up at intervals and connected in order to form a return airway, and a stapple pit some 16 feet deep was sunk to the back or return stone drift. Tunnels or drifts were driven into the Little seam also from the same level, and additional levels set away in that seam right and left parallel to those in the Deep seam. These form the intake airways of the mine. Beyond driving the exploratory levels on the west side, nothing further has been done; so that this description of the mode of working refers to the east side only,—although in the course of time, it may be adopted throughout the mine. Furthermore, it must be borne in mind

that so far as the work has progressed, it has been conducted on a limited and purely experimental scale.

Counterbalance planes, 400 ft. apart, are driven to the full rise from the main haulage level in the Deep seam, and as near to the old sealed workings of the Cage Pit as is considered prudent, the proximity of these old workings being proved by bore holes. From these planes, bords 12 ft. wide and separated by pillars of coal 47 ft. thick are turned away to the left, and when they have been driven in a distance of 66 ft., drifts or tunnels 6 ft. square, are started from the low side of each bord and nearly at right angles to them and driven on a rise of from 1½ to 2 inches per yard until the Little seam is reached. Connection is then made in that seam between the several tunnels or drifts, and the longwall face thus established. Timber chocks 9 ft. long by 4 ft. wide are built on each side of the tunnel where it enters the Little seam, and booms of large dimensions stretched across, in order to protect it when the weight comes on. The length of wall or face assigned to each set of men, is governed by the dip and thickness of pillar left between the bords in the Deep seam. It is now about 51 feet. As the face advances, it becomes necessary to afford support for the roof, in order to keep the roadways open for the transport of the coal, and for this purpose, principally, the roof is blasted down or as locally termed "brushed." The roof so far as it has been penetrated consists of fireclay of varying degrees of hardness, that immediately overlying the coal containing much ironstone in nodules. At from 2 feet 6 inches to 3 feet from the top of the seam, there is a parting of soft black fireclay and the first brushing generally extends up to this. The amount of stone brought down is not more than sufficient to build a pack wall—from 9 to 12 feet wide—on the low side of the roadway, consequently timber chocks 4 feet square and not farther apart than 2 feet are built along the high side and filled in with any loose debris there may be lying about. The width of the roadway or gob-road properly speaking, is about 9 feet—that is between the packwall and the chocks, and the space between the chocks and the packwall to the rise locally known as the "cundie"—(Scotch for conduit)—is therefore not greater than 29 or 30 feet. Props are set at variable distances apart along the face to secure the men, but in no instance has the roof fallen nearer to the face than 20 feet. Occasionally falls of roof up to the black fireclay parting take place back in the cundie but they are of no moment. The lower end of the face or wall is kept slightly in advance of the upper part as shewn in fig. 1.—and thus affords full advantage to be taken of the direction of the cleat and joints. The line of fracture of the roof runs slightly to the west of full dip.

As the face advances, the heaving of the pavement is soon noticeable, and the back props—many of which are left in, are readily broken. The general effect produced by the extraction of the coal, appears, so far as observed, to partake of the character of a creep, inasmuch as there is a gradual subsidence of the roof, coupled with an upheaval of the floor, equally as regular in movement. Packwalls and chocks at the outbye end of the work, which, six months ago, were over 4 feet thick are now compressed into a space of less than one foot. This coming together of the roof and pavement necessitates recourse to more brushing and at the present time the outer end of the gobroads is almost entirely up in the solid roof.

While the operation of drifting into the Little seam is in progress, the bords in the Deep seam continue to advance, and the lead thus obtained is held until the limit or divisional barrier between the balances is reached. The ratio of advance as regards the bords to the longwall is as 3 to 1 and the output per man employed is very slightly in favor of the bords.

Each wall or face is let to a set of men, generally four in number, and they are paid a fixed price per ton for all coal sent to bank which is practically the whole seam, for there is no loss or waste in working. The brushing is paid for by the lineal yard and for these two considerations, the men undertake to do everything in connection with the work, excepting the firing of shots, which is done in compliance with the law by the deputy overman. The quantity of explosive used compared with the consumption in the bord and pillar work generally, is about one third. The undercutting or holing is done in the bottom part of the seam, as there are two thin bands of hard ironstone separated by an inch or two of coal, immediately under the seam. The holing extends forward from three feet six inches to four feet, and as the jud is formed, sprags are used to support it until the undercutting is completed, when they are withdrawn and the coal brought down. Instances have occurred where the greater part of a shift has been employed in undercutting the whole length of the face, and on returning on the following day the jud has been found to have come bodily away and broken up into large masses. The opportunity of learning the proportion of round or lump coal produced by the longwall, for comparison with the quantity from the bord and pillar work has not yet occurred, because the output from the little seam being small, no care has been taken to keep it separate from the produce of the other parts of the mine.

The ventilation is simple. The intake air enters by the main stone drift and passes at once into the level in the Little seam. It splits at the inbye heading in that seam, and while sufficient is taken directly to the longwall faces, the bulk is made to traverse the workings in the Deep seam. At the highest point in the longwall working, a small pit is put down on the bord below, and the return air meets at this point, the return from the the Deep seam, and together they travel down the balance, along a level to the stapple pit and so into the

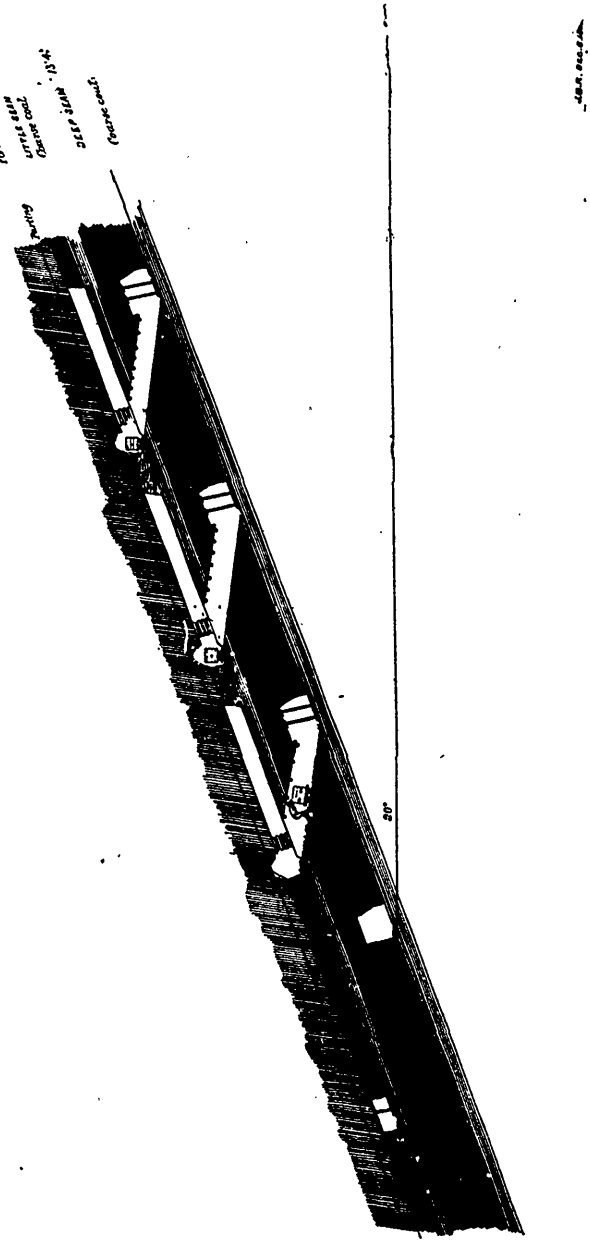


FIG 2.—PARTIAL SECTION on LINE A.B.

MODIFICATION OF WORKING COAL IN NOVA SCOTIA.

Plate II.—Illustrating Mr. J. G. Rutherford's Paper.

back stone drift and thence by the return airways in the third seam to the fan shaft or upcast.

Of course the intention is, when the longwall face shall have reached the barrier proposed to be left next the inbye balance, to withdraw the underlying pillars in the Deep seam, but with what success this may be accomplished is as yet a matter of conjecture.

When the circumstances are favourable—and in the case just described this appears to be so—the advantages to be derived by working on the longwall method are too well known to need comment here.

With respect to the drawings accompanying this description, it may be well to add a word or two in explanation. Fig. 1 is intended to represent the longwall work in the Little seam, and the underlying workings in the Deep seam are shewn by white dotted lines. The balance on the right hand is the one at present in operation, and the one further to the east or left, is intended to represent the process of developing a new longwall face. It will be apparent that by this system of working, the counterbalance planes in the Deep seam carry all the coal given both by the longwall and the bords. Moreover, another important advantage which the method affords, is gained by working in panels or districts separated by barriers of coal, for in the event of a gob fire, and such are not unknown, the facility with which a district can be speedily isolated is readily apparent.

It will be observed that the three lower bords of the left hand balance, have been connected with the Little seam by means of the drifts. The two lowest of these drifts have in turn made a connection with the Little seam, while communication between the second and third headings is not yet completed. The fourth has nearly effected an entrance into the Little seam, and the fifth is only about half way through.

Figure 2 is a partial section on the line A. B. and shews the method of connecting the two seams by the drifts, through one of which a box of coal is being brought to be placed on the balance cage in the lower seam. The packwalls of stone are shewn on the dip side, and the timber chocks to the rise.

[2] Acadia Colliery, Pictou County.

By Mr. James Maxwell, Manager of the Acadia Pit, Acadia Coal Company, Westville, N.S.

The seam dips at an angle of 27° to 30°, and until the workings reached a vertical depth of 1,200 feet, the method of working was by driving back balances to the full rise 400 feet, and breaking off bords on a level course inbye for a distance of 400 feet, and then working the pillars on a nearly straight face to the full rise back to the balance.

Where greater depths were attained the method that had answered so well heretofore failed, and it mattered not how narrow the primary openings were made, the pressure soon wrecked them. A change of system became inevitable. As narrow places could not be kept open by timber, even where placed skin per skin, it was determined to try an opposite course and make the working places wide. So far successfully, and the method adopted is to drive headings 26 feet wide to the full rise or pitch of the seam, carrying up on the intake side 2 feet from the cone a packwall with timber 5 feet wide, a space 6 feet wide is then left for a travelling way and for working a counterbalance that takes up timber. Then follows up the centre of the heading a chock pack 5 feet wide separating the travelling way from the coal chute, which is made 6 ft. wide. Another similar pack 5 feet wide, forms the other side of the coal chute, and being placed 2 feet from the coal makes a return airway when the heading is being driven up.

At right angles off the chute, walls are started every 12 yards, and a pack 5 feet wide is carried on the low side 2 feet from the wall; then a space 7 feet wide serves for the track on which the tubs run to and from the working face. A continuous chocking 5 feet thick on the high side of the road leaves an open space about 17 feet wide to fall in, which it does on every advance of 5 or 6 yards. These falls return the pressure on the roads which stand fairly well for a distance of 200 feet, the length between the headings.

The thickness of coal worked in these walls is 6½ or 7 feet. In the roadways other 2 feet of bottom is taken up and the material stowed in the packs. The height of 9 feet thus obtained is generally sufficient to allow for the settlement due to the pressure. The chocks on the low side of the roadways are placed about 3 feet apart to leave space for stowage. The chocks on the high side are placed close together to prevent the gob from falling on the roadway.

The face is not in a straight line, but worked in steps the better to prevent it being closed, which it is apt to do when the falls take place.

The shales forming the roof are very soft, and require cross timbers every 4 feet resting on the chocks.

The chock wood is taken up in schooners, long narrow bores running in a 16 inch track with a passing place in the middle of the travelling ways. The schooner at the top of the heading on being loaded with coal, acts as a counterbalance to take up the one below loaded with a less weight of chock wood. The coal from the faces is dumped into the chute down which it slides on iron sheets to the level below, where it is loaded with boxes carrying a ton each.

It is interesting to note that while bords 9 ft. x 7 ft. within a few weeks of being driven were reduced in size by the pressure, both on the tops and sides to such an extent that a box 4 feet square could no longer pass, places driven wide and but little higher to allow for the settlement of the strata have required but little attention to keep them open.

[3] Joggins Mines, Cumberland County, N.S.

By Mr. James Baird, Maccau, N.S.

The seam of coal at present worked at the Joggins Colliery lies at an angle of 17 degs. with the horizon and is opened out by a slope driven in the seam direct to the dip, a distance of 1900 feet or 2300 feet to the face of our present sinkings and the vertical cover at this point is about 670 feet. The seam is from 6 to 9 feet in thickness and of the following section in ascending order:—

Bench coal	2 feet
Fireclay	1 to 3 "
Fall coal	3 to 4 "

There is a good hard roof, the sandstone in some places being in contact with the coal.

Up to September, 1890, this seam was worked by bord and pillar, but on taking charge of the mine at that date I altered the system to longwall pure and simple as it is termed. The fireclay band being of too soft a nature to build walls with, I was obliged to adopt wooden butts 8 ft. by 4 ft. built as shown on the accompanying sketch and for this purpose I used mostly any size or kind of timber I could get. I found the best plan to keep our roads and faces safe was to place the butts lengthwise to the roads and not farther apart than 4 feet. As will be seen by the plan, I had a good chance to try the different methods of keeping roads and face of work. The cross-roads or half angle across the dip I consider a good plan. They are rather steep for horses but work well by self-acting inclines. We drive these places 360 feet which I am of opinion is a good length for roads straight uphill or half across and with seven or eight working faces of 50 feet to each set of men, makes good work. The straighter the face is kept the better; no jogs nor corners to take extra weight.

When the seam is 8 feet or over in height we can run our tubs with very little brushing. I might mention one point in longwall working is to have the right plant, viz.:—narrow gauge and low tubs, put in at first; it is much easier to make plant for the mine, than to make the mine for the plant. The roof sometimes bends quite gradually; at points, it breaks heavily. We have been very fortunate in the way of breaks, never having had a butt thrust out of its place and the roads have always kept good under the most severe strain.

The system of ventilation is simple, most of the air travelling along the different faces of work as shown on the sketch.

I also give a sketch of faults met with on our 1900 feet level going east, which we have put through successfully with our longwall work and I have yet to learn where the extra cost comes in compared with putting through faults when working bord and pillar.

Some writers claim that longwall pure and simple, can be worked only in thin seams lying flat or at an easy angle, with a good hard roof, free from faults, &c., while others say that any seam lying at any angle and with any kind of roof can be worked by that method. I fancy that the first miner of coal was a longwall worker, and that the first break of the roof made him alter his system, and there have been a good many men follow him in that way. In longwall the great difficulty is to keep the face of work secure in order that men may mine and load their coal easily and in safety. The first break of the roof is looked forward to with interest as it is always a test of the butts or buildings put in to maintain the roadways, or as some claim, whether the roof is too hard or too soft for longwall work.

I may draw your attention to the fact that our present lift is being sunk on the long-wall system. You will notice that we are taking all the coal out, not even leaving slope pillars, but building butts of timber on both sides, and I consider it will be, when finished, and the measures once settled down, the best part of our slope.

Generally, every few years slopes have to be retimbered, and especially where the pillars have not been left large enough, great expense is entailed in maintaining them in order, but in this case by longwall, once timbered forever timbered. Certainly I lay myself open to criticism in this assertion, but I hope to be able to defend my action.

As we must all learn by experience, and if that experience does not cost the companies we work for anything, but saves them money, then we, as managers, should be safe in experimenting.

In conclusion, I can safely say that the adoption of longwall at the Joggins has been a benefit to all concerned; the miner gets more coal with less labor. A greater quantity of timber is consumed, but the additional cost is more than offset by the other advantages.

No explosive is used by the miner in getting the coal and only a very small quantity in brushing the main roads.

[4] Gowrie Colliery, Cape Breton.

By Mr. Charles Archibald, Cow Bay, C.B.

In responding to the request of the Council to read a brief paper on the system of working coal at the Gowrie mines, I do so feeling that it will not contain anything new or interesting to my mining friends. The intention I understand is to get opinions at this meeting on the longwall system of working. The pillar and room system has been universally adopted at the coal mines in Cape Breton, until the Gardener mine very recently changed from that system to longwall.

The MacAulay seam worked at the Gowrie mines varies in height from 4 ft. 8 in. to 5 ft. 6 in., but the usual or mean height is 5 ft. It has always been worked on the "pillar and room system." For many years the rooms were driven six yards wide and the pillars from five to seven according to circumstances.

The coal dips at an angle of 8¼° clear, the crop flattening as is usual towards the basin, and for the past ten years the dip has averaged about six degrees. The method of working is as follows: Two levels, the upper or main, and the lower or water level, are driven nearly on the end of the coal with a ten yard pillar of coal between and the rooms are turned up the hill or to the pit from the main level. The coal dips to the northward, and while the levels are about seventy degrees west of north, and correspondingly seventy degrees east of south, the rooms are all driven south. The upper level is driven ten feet wide, the roof being good and safe to allow this width, and spare roads can be laid down without the expense of widening; the lower or water level, is about eight feet in width. Cross-cuts are made usually one chain apart, and slant roads take the place of cross-cuts where required.

No powder is used except on the levels and cross-cuts; the coal is undercut or holed about three feet, or a pick-handle, sheared on one side of the room and brought down by steel wedges. The nature of the coal of course favors the wedging system, as there is a perfect parting at the roof, and a roof coal varying from four inches to eight inches which is separated and stowed in the roof.

For many years the rooms were driven narrow, or the ordinary width of six yards; the roadway was laid up the centre of the place and the roof coal, and when the coal was riddled the slack was stowed on each side of the roadway against the pillars. The expense and inconvenience of clearing the pillars to remove them was one of the causes that induced the change of working, and about twenty years ago the plan of driving the rooms ten yards wide and leaving the pillars the old width was adopted and has continued successfully ever since. By this plan the roadways instead of running up the middle of the rooms were laid about three feet from the side of the pillars; the centre of the room was well timbered, and the roof coal and any refuse was thrown or stored in the centre of the place, thus leaving the face of the pillars clean. The pillars were removed to great advantage and with comparatively little expense; the rooms were driven to a counter level, and after leaving a pillar sufficiently strong to protect the roadway or counter level, the pillars were brought back; the rails being taken up on the retreat and the top allowed to come in. Besides the advantage gained by cheapening and facilitating the withdrawal of the pillars, the wide room, or, as it might be termed, the semi-longwall system, enabled the getting of more coal by the same number of men than if they worked in narrow rooms. Another felt advantage was that a larger percentage of coal was drawn for the same amount of narrow work before the removal of pillars. By narrow work I mean levels and cross-cuts, as for example roughly, the rooms being ten yards wide and the pillars six, we get ten-sixths or one, and two-thirds as against one, or two-thirds more. The removing of such a large percentage by rooms may not appear to some a pecuniary advantage, as miners are generally paid at a less rate per ton for removing pillars, but my experience in working the MacAulay seam has proved that the wide room system beside other advantages has been a pecuniary success.

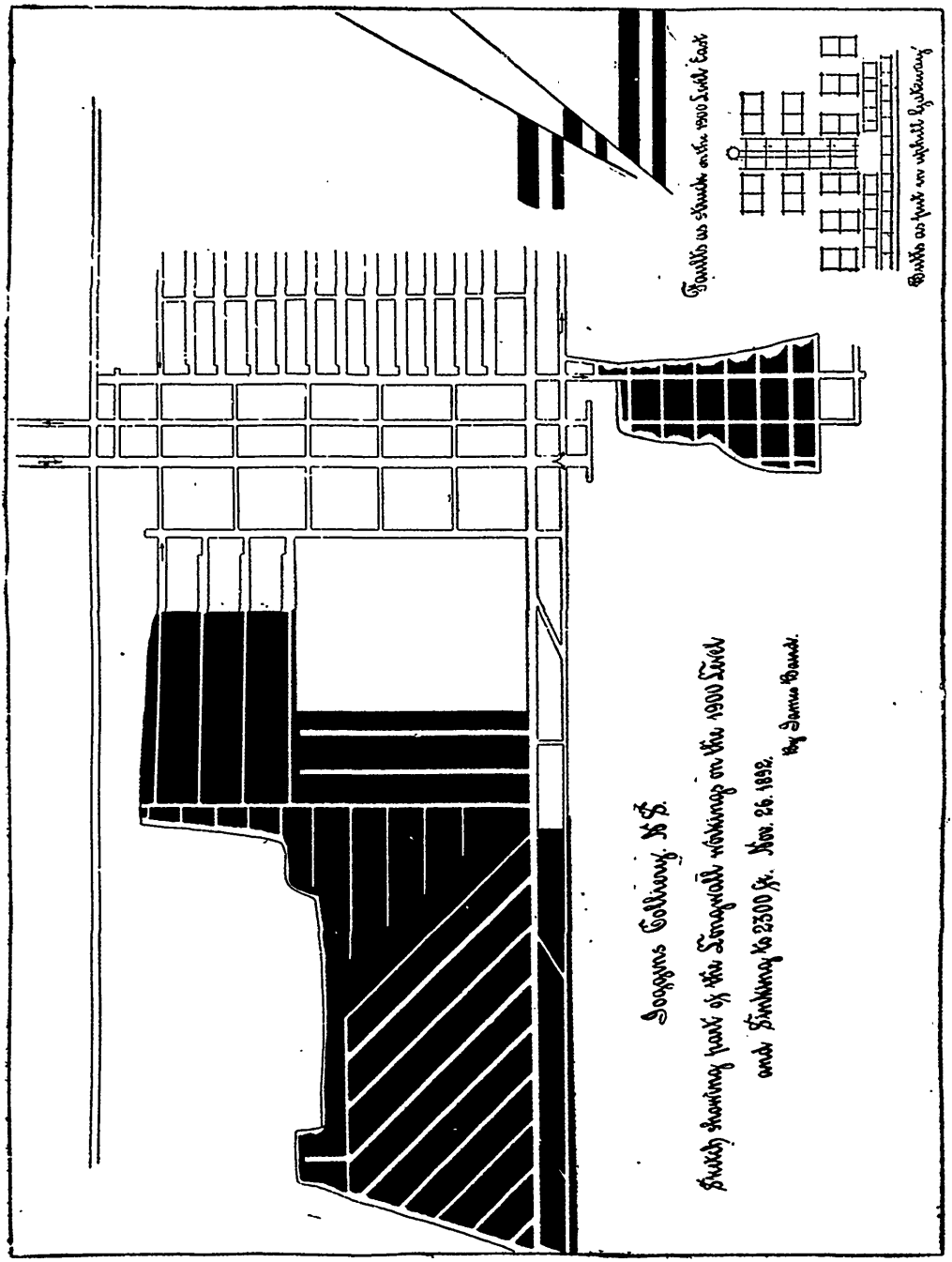
I am well aware that the working of wide rooms successfully depends upon the height of the seam, and more particularly on the nature of the roof; and in a mine where close timbering was required, it would not pay, and in many cases would be impracticable.

The roads laid up each side of the room are kept about three feet from the pillar; the space allowed for the roadway is about six feet from the side of the pillar; a row of props, five inches or more in the small end, are set under cap pieces and extend from roadway to roadway. Usually only four or five are used in each row, placed about four to five feet apart. These rows of props are put about every five feet. If necessary, of course more timber is used.

In breaking off rooms, they are started narrow from the level pillar, say six yards, and gradually widened until it reaches ten yards; the widening is done on one side, thus leaving one straight side from the level to face. When the rooms are started two roads, one alongside of each pillar, are used, but when the room is advanced some distance, to economise in the use of rails, a sweep is put in and at that point there is only a single road to the level.

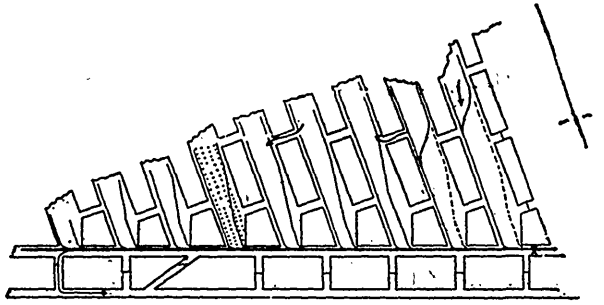
The coal is filled into boxes, containing from twenty-five hundred to thirty-five hundred pounds each, and the difference depends upon how the miner fills and heaps his tubs.

I trust that this brief description, together with the rough sketch, will enable everyone present to understand the very simple method of the wide room system adopted at the Gowrie mines.



MODIFICATION OF WORKING COAL IN NOVA SCOTIA.

Plate III.—Illustrating Paper by Mr. James Baird.



MODIFICATION OF WORKING COAL IN NOVA SCOTIA.

Plate IV.—Method of Working Wide Rooms at the Gowrie Mines, Cape Breton, illustrating Paper by Mr. Charles Archibald.

Notes on the Economic Minerals of New Brunswick.

By Wm. McInnes, of the Geological Survey of Canada.

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 contained 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 felspathic sandstones of supposed cambro-silurian age, hold stibuite in greater or less quantities. 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 blacksmiths' 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 occurring at many points in southern New Brunswick as a grey 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 Laurentian 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 principal 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 of the Chaudiere district, carried down the valley of the St. Lawrence and thence southward with the ice which has scattered boulders of Laurentian 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 to 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 plications 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	

An analysis of the pig by Mr. Wendt, M.E., gave :—

Phosphorous	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 consists 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 aggregations, 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 argillites 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 properly 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 o. 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 Work, 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 41 A 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 natimaceae. 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.

* Paper presented at the International Mining Convention, Montreal.

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 merit 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. O. 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 haphazard. 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 85 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 experiment 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 are 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 ¼in. mesh is mentioned 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 the 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 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 30 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 oxidized 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.

SECOND ANNUAL GENERAL MEETING

OF THE

Mining Society of Nova Scotia

At Halifax on 29th ulto.

The Second Annual General Meeting of the Mining Society of Nova Scotia, was held in the rooms of the Society, 129 Hollis Street, Halifax, on Wednesday, 29th March. Among others present were noticed: H. S. Poole, M.A., F.G.S., (Acadia Coal Co.), Stellarton, N.S.; John E. Hardman, S.B., M.E., Oldham, N.S.; Capt. Geo. MacDuff, Waverley, N.S.; A. A. Hayward, Waverley, N.S.; J. M. Reid, Oxford Mines, Musquodoboit, N.S.; C. E. Willis, Halifax; B. C. Wilson, Waverley; Chas. Archibald, Cow Bay; J. H. Austen, Halifax; W. G. Matheson, New Glasgow, N.S.; Wm. Smaill, Londonderry; R. G. E. Leckie, (Torbrook Iron Co.), Torbrook; Alfred Woodhouse, F.G.S., Montagu; Geoffrey Morrow, Halifax; G. E. Francklyn, (General Mining Association of London, Ltd.) Halifax; Duncan McDonald, Truro, N.S.; George W. Stuart, Truro, N.S.; T. R. Gue, Halifax; Alfred Dickman, Halifax; D. W. Robb, (Robb Engineering Co.) Amherst; Howard Clarke, Halifax; C. S. Harrington, Halifax; W. R. Thomas, Montagu; Dr. Gilpin, Deputy Commissioner of Mines, Halifax; W. H. Huggins, Halifax, and H. M. Wylde, Halifax, Secretary.

MR. H. S. POOLE, M.A., F.G.S., President, who occupied the chair, called the meeting to order at 10.30 a.m.

THE SECRETARY read the minutes of the regular Quarterly General Meeting, held in December, and of the special meeting held in Montreal during the sessions of the International Mining Convention.

MR. JOHN E. HARDMAN—It would be well to add to the minutes of the Montreal meeting that the Government had acceded to the request of the Society "that the Province of Nova Scotia should be represented at that meeting." The Government of Nova Scotia were perfectly willing that Dr. Gilpin should attend, but owing to pressure of business Dr. Gilpin could not get away, and as a matter of fact all the members who were present at Montreal know that the Premier, the Hon. Mr. Fielding, was present and represented Nova Scotia admirably. I beg to move that the minutes be amended in this respect, and that it be placed on record that the Government acceded to our request.

On motion the amended minutes were approved.

The following names for membership were handed in: Mr. A. Drysdale, Mr. Graham Fraser, Dr. James McKay, Mr. Herbert Dixon and Mr. C. F. Andrews.

Upon motion of Mr. Willis, seconded by Mr. Chas. Archibald, these gentlemen were duly elected members.

THE PRESIDENT—The Council recommends, in regard to Volume I, Part II, of the Transactions, which has not yet been printed, that it be issued and embrace all that has been made public relating to the formation of the Society, including the notes in regard to coal legislation and matters relating to the agitation of a year ago. Will anyone move that the recommendation of the Council be adopted?

On motion of Mr. Hardman, seconded by Mr. Howard Clarke, the recommendation of the Council was adopted.

The Duty on Mining Machinery.

A letter from Mr. B. T. A. Bell, Secretary of the General Mining Association of the Province of Quebec, under date of 24th March, with reference to the Customs regulations relating to the imports of mining machinery was read.

THE PRESIDENT—The idea of the Council was that a committee should consider the matter and report at our next meeting.

MR. C. E. WILLIS—If there was any serious action taken on this subject and a list furnished the Department it might be the means of getting us into a bad trap. There are new machines being manufactured every day and if we furnish the Government with a statement, we might leave out these. This is a matter which should be looked into very carefully.

THE PRESIDENT—We could have on our committee such men as Mr. W. G. Matheson, of New Glasgow and Mr. D. W. Robb of Amherst, who are in a position to say what machinery was manufactured in Nova

Scotia. The list to be furnished the Government would only have to include such articles as can be supplied in this country.

MR. C. E. WILLIS—If we make a statement will the Department confine us to only these items which are contained in it?

THE PRESIDENT—The list would only show such as are manufactured in this country.

MR. W. G. MATHESON—The idea which I have got is this—not a list of articles that pay duty, but a list of articles that are *not* to pay duty, so that the statement would include any machinery made abroad.

MR. HOWARD CLARKE—I think the simplest way would be to make a list of what is manufactured in the Dominion, and have all other machinery admitted free. A list of what is manufactured here could be easily made out.

MR. JOHN HARDMAN—Let us make a list of what shall be charged duty and not a list of what is *not* charged duty.

MR. CHAS. ARCHIBALD—Would it not be possible for the Government to arrange with the different Collectors of Customs to pass machinery which was not manufactured in this country upon the party making a declaration to that effect?

THE PRESIDENT—That is the law now. You have got to make an affidavit that it is not manufactured in Canada.

MR. CHAS. ARCHIBALD—It would be a difficult thing to make a list of all that is made.

MR. JOS. AUSTEN—In making the affidavit under the law now, we not only have to state to the best of our knowledge and belief that the article is not made in Canada, but that it is Mining Machinery, and that it is to be used in a specified mine. That is the form of the affidavit we have to make.

MR. JOHN HARDMAN—This matter came up in the meeting of the Quebec Association in February. It was then stated that they did not get the same ruling from Collectors of Customs in the Province of Quebec, that we get from the Collector of Customs in Halifax. The Collector would not take their affidavit as to whether or not it was mining machinery, and the Quebec Association desired to have the interpretation of the law taken out of the officials hands.

MR. T. R. GUE—I think we would undertake a large contract to make a list specifying all kinds of dutiable mining machinery. I would make a suggestion that it is too far reaching to cover all. The President spoke of Mr. Matheson and Mr. Robb, whose business is making mining machinery quite largely—could they not specify what is made here, by themselves and others, and the Secretary could correspond with the manufacturers in British Columbia, Hamilton and elsewhere, and make a report? Of course such a report would cost them considerable time and trouble—but as those gentlemen are interested in the manufacture and sale of mining machinery in this Province, they could make such a list. The Government would scarcely question anything that the collector did who conferred with this committee. If you do anything else I am afraid it will not have the effect we want it to have, and will not be far reaching enough. These men are interested in the manufacture of mining machinery and they are not going to report for free entry upon machinery they can make here. If you put it on that ground I think you will get it in a shape the Government will not undertake to question. The things the committee recommend should be free. The only question is, are the gentlemen to be named willing to devote their time to making a complete list?—I think they will.

MR. J. M. REID—I have been importing machinery for the last two or three years, and I find a great deal of trouble getting it in, whether of a class manufactured in Canada or not, and several times I imported machinery not manufactured in Canada, which I did not succeed in getting in free of duty. If we can get up a list of what shall not come in free we have got a big contract before us, but if we get up a list of what shall come in free we have the list.

MR. JOHN HARDMAN—This is a matter which would be discussed much better in committee than by the whole Society; I move that the matter be referred to a committee to be appointed by the President.

MR. CLARK—I second the motion.

MR. J. M. REID—I wish to be placed on record against furnishing the Government with any list.

The motion upon being put was duly carried.

The Chair then appointed the following gentlemen to form the committee:

Messrs. T. R. Gue, Geoff. Morrow, Jos. Austen, D. W. Robb, W. G. Matheson and Duncan Macdonald, with power to add to their number.

Election of Officers.

THE SECRETARY—It would be well, in order to expedite business, that the Chair appoint a committee to take the nominations received, and report a slate suggesting the names of the officers and council for the ensuing year, as the first business of the afternoon session.

Upon motion duly passed the Chair appointed Mr. Smaill, Mr. Austen and the Secretary.

June Meeting, etc.

THE PRESIDENT said the Council hoped to be able to announce that the June meeting would take place in Pictou County, with excursions to the iron works, steel works and some of the collieries in that neighborhood. He then called upon Mr. W. G. Matheson to read his paper on Fuel Economy, regretting that the text of the paper had not been received in time to have it printed. Mr. W. G. Matheson then read a paper on the subject of Fuel Economy. A vote of thanks was duly tendered Mr. Matheson for his valuable paper, the President remarking that if the Society published no other paper in their *Transactions* for the year, members would get more than the value of their dues in the practical suggestions it contained. Discussion on the paper followed. This was followed by a paper by Mr. B. C. Wilson, entitled "Notes on some special Features in Lode formation and deposition of Gold as presented in the Waverley Gold District." A vote of thanks to Mr. Wilson was passed, and the paper was discussed by members present.

The meeting then adjourned until 2.30 p.m.

Afternoon Session.

The members assembled in the rooms at 2.30 p.m.

A letter was read from Mr. J. R. Lithgow resigning his office as Treasurer to the Society. The resignation was accepted with regret.

Report of Council for Year 1892-93.

The following report of Council for the year 1892-3 was submitted and adopted.

The Council for the past year beg to submit the following report of what has been done by this Society during the past year.

The number of members who joined at the inception of the Society was 58, and other 17 members were elected during the year making a total of 75, of whom only three have resigned their membership.

Briefly stated the Society's income and expenditure during the past year has been as follows:—

Receipts—Balance received from Gold Miners Association in lieu of fees of 18 members of that Association...	$ 15 43	
Subscriptions collected for 1892.....	487 75	
Total.....		$553 18
Expenditure—As per Treasurer's Statement.....		$438 05

leaving a credit balance on 1892 account of $115.13. The subscriptions due and not yet paid amount to $25.00 of which $15 is placed as good and $10 as not collectable. The estimated income for the current year is $720.

Meetings—Since its organization the Society has held four regular meetings and one special meeting—and while referring to this, the Council desire to call attention to the very enjoyable quarterly meeting held at Londonderry on Sept. 7th and to the hospitable manner in which the members present, were entertained by Vice.-Pres. Leckie and staff of the Londonderry Iron Co. The special meeting was held at Montreal on Feby. 20th, on the occasion of the convention of the Mining Societies, when some 35 of our members were present.

Transactions—The Transactions for the year—Vol. I, include Part I (in press) on the formation of the Society and the petitions of lessees to the Governor General of Canada and the Lieutenant Governor of Nova Scotia respecting certain legislation of the Parliament of Nova Scotia affecting mining.

Part II—Contains a report of the first meeting of the Society and papers read by the following gentlemen:—

E. Gilpin, Jr., LL.D., F.R.S.C., on "Notes on Nova Scotia Iron Ores."

H. S. Poole, A.R.S.M., F.G.S., on "The introduction of new Explosives for coal getting in Nova Scotia."

J. S. McLennan, B.A., M.E., on "Changes in the Rank at the International Colliery."

J. E. Hardman, S.B., M.E., on "Recent Gold Milling Practice in Nova Scotia."

Part III—Contains a report of the second quarterly meeting held at Londonderry and papers read then.

R. G. Leckie, M.E., on "Roasting and Smelting plant at Londonderry Iron Works."

R. G. E. Leckie, C.E., on "Iron Deposits of Torbrook."

Wm. Smaill, on "Notes from Laboratory on some Iron ores from Nova Scotia."

Part IV is now in press and will contain a report of the December quarterly meeting and the special meeting held at Montreal in February.

Library—It is gratifying to the Council to be able to report that the nucleus of a library has been formed. The Society has some forty-five names on its exchange list, a considerable number of whom in return mail the Society their publications, and it is expected during the coming year that this number will be increased.

The Council would impress on members the desirability of collecting copies of all printed reports on mining properties in the province, even of those seemingly of no present value, with a view to keeping a record of the history and development of the industry. Where possible these might be supplemented by photographs of appliances and establishments.

Museum—The substantial collection of iron ores used to illustrate Mr. Smaill's paper read at the Londonderry meeting have been presented by him to the Society and are now on exhibition. It forms a valuable nucleus of what it is hoped will prove an attractive feature in the rooms of the Society, and the Council takes this opportunity to urge members to add to this collection by donating specimens of the various ores and minerals with which they have to do.

Quarters—Through the generosity of Mr. T. R. Gue, president of the Acadia Powder Company, a spacious room at 129 Hollis Street, in Halifax, has been fitted up and set apart for the use of the Society and it seems fitting to the Council to here also record the obligations of the Society to Mr. Gue in this respect.

Treasurer's Statement—The Treasurer's statement is respectfully submitted herewith.

President's Address.

MR. H. S. POOLE—When a year ago a general call to all engaged in mining in Nova Scotia brought together a goodly number of those interested both directly and indirectly, the most sanguine amongst us I cannot think anticipated the response that was then made and which it is my proud position to record to-day. The appeal touched a sympathetic chord in members of every branch of the profession, among quarrymen, among miners of gold, of coal and of iron, the moment was evidently opportune, and from adversity in the grasp of imposition sprang this society into being.

It had been felt before, but in a vague and general way, that organization for a proper consideration and due advancement of interests common to all branches of mining in this province was desirable, but the feeling found only a divided expression in the formation of local associations and temporary gatherings that met to consider, and perhaps expose, actions of adverse tendency, so that when the matter in question was settled, the cause for unanimity being satisfied, the several elements, but temporarily united, again fell apart. Heretofore protests have been made by individuals sometimes alone, sometimes with others against immature or ill-advised mining legislation, with what effect may be gathered on turning over the pages of the Statute Book and noting the amendments that have been made, and the self-evident contradictions that have remained recorded and unrepealed for years. At times modifications have been obtained and then the seekers, after decisive enactments, have dropped back to their ordinary avocations and unorganized condition; contract being broken the moral weight of a combination was lost, not only for a time, but weakened also when the combination was renewed, since experience anticipated it would be but temporary.

The under current of general interest that led to these local and spasmotic gatherings however failed to find unanimous expression until the experience of the mining men of Quebec,* the formation of the General Mining Association of that province under somewhat similar circumstances and the success which attended their appeal to the public for a careful hearing of their grievances made patent to all in like case in Nova Scotia that in union they might with good management and a just cause hope to stem the tide of imposition, gain the public attention and show the partiality that singled out the mining industry for restrictive legislation and the imposition of requirements not otherwise imposed on other industries.

The spark that at last lit the beacon possibly was that which fell from the Premier of the Province when he remarked to certain deputations that presented to the Government their isolated views on some proposed legislation, why do you not decide among yourselves as do other industries and present your case as a united expression, then the Governmeent will as far as possible meet your wishes. Perhaps it was this spark that caught the inflammable material in the loose sticks that hitherto individually had crossed each other and phantomlike from their ashes had bound them together into a bundle that it is hoped will long continue. At any rate when the call was made, *the response was not halfhearted, the time* was evidently ripe and lessees rallied to the watchword:—

"Sanctity of Contract,
Fixity of Tenure and
Accuracy of Location."

Thus it was that the Mining Society of Nova Scotia took form and substance, and to-day we find ourselves organized with a membership numbering 75 and with representatives almost without exception of every company engaged in active operation.

Nor can it be overlooked how much this Society is indebted to its local forerunners the Coal Owners Associations of Cape Breton and Pictou Counties, and above all to the Gold Miners Association which during the four years preceding its amalgamation with this Society did so much for its members and by joint representation affected so many changes in that part of the chapter "Of Mines and Minerals" relating to gold mining that of these matters they were fully justified in expressing satisfaction for the consideration received at the hands of the present administration. What the changes were that were effected I trust to see fully recorded in our Transactions. Already we see a new organization profiting by the experience the old lessees so rudely acquired last winter. The Whitney Syndicate which has since became the chartered Dominion Coal Company is indebted to this Society for making clear to them the desirability of having in their lease a right to appeal to the Courts for settlement of disputes which may turn on the meaning of the wording in their leases. This has been acquired. What in substance the old lessees said last winter was:—Place us in the position of John Doe in dispute with Richard Doe over the legal meaning of our Indenture, let the courts decide and it will effectually stop all the talk about home and foreign capital having been misled into believing the sacred name of Her Majesty is used in the leases as typical of good faith, and the implications that the sanctity of contract has been violated when the *power* of the Legislature to convert "might" into "right" has been invoked, the Legislature being, as a landlord in the case

*CANADIAN MINING REVIEW, July, 1891.

in question an interested party. This right of going into court the old lessees have not as yet been granted.

Elsewhere I have drawn to your notice the incongruities which mark the legislation respecting the working and regulation of mines and their probable cause, by other of our members it is expected the remaining portions of the legislation included in both the chapters that deal with the leasing and working of mines will be reviewed. These matters of undoubted moment to our Society will, it is hoped, before long cease to be active questions, and that then our individual attention can be given to reporting and discussing the many improvements and modifications which the rapid advances in the devices and arts place at the service of the miner. Our gold miners have no cause to fear competition in their business and do not object to share with others the benefits derived from changes in mining and milling practices; our coal members feel that when they have introduced an improvement in their pits they will not long be able to keep it hidden from their fellows and therefore that they may as well openly talk of it and get any credit there may be due for its introduction; while those of us who have met with disasters need not think our blunders or misfortunes will pass uncriticized because we ourselves say nothing about them, so we may as well make a virtue of necessity and point out if we can to others the way to avoid the pitfalls into which we have tumbled.

I would especially urge on members the advantage of having their papers for the quarterly meetings prepared well beforehand, and remind them there is a wide range of subjects and material open to them. Long papers are not necessarily asked for, concise statements of facts of which the writer is thoroughly conversant are preferred. The history of early mining practices in this country is of interest, while the more rapid developments of late years open fields that will extend as time rolls on and change succeeds change in methods of working, in facilities for production and transportation, and in substituting mechanical power for the more arduous manual labor.

Election of Officers.

The officers for the ensuing year were elected as follows:

President—H. S. POOLE, F.G.S., general manager Acadia Coal Company, Ltd., Stellarton, N.S.

1st Vice-President—JOHN E. HARDMAN, M.E., S.B., Oldham, N.S., manager Oldham Gold Company, and West Waverley Gold Company.

2nd Vice-President—R. G. LECKIE, general manager Londonderry Iron Co., Ltd., Londonderry, N.S.

3rd Vice-President—DAVID MCKEEN, M.P., Glace Bay, C.B., resident manager Dominion Coal Co., Ltd.

Treasurer—T. R. GUE, Halifax, N.S.

Secretary—H. M. WYLDE, Halifax, N.S.

COUNCIL:

Charles Archibald, North Sydney, C.B.
R. H. Brown, Sydney Mines, C.B.
Charles Fergie, M.E., Westville, N.S.
Graham Fraser, New Glasgow, N.S.
E. Sjostedt, Bridgeville, N.S.
D. W. Robb, Amherst, N.S.
B. C. Wilson, Waverley, N.S.
George W. Stuart, Truro, N.S.
Joseph H. Austen, Halifax, N.S.

In the evening the Society held its annual dinner at the Halifax hotel. The *menu* did credit to host Hesslein, and was thoroughly discussed by the large number of members and guests in attendance. Mr. H. S. Poole, of Stellarton, the president, occupied the chair, and on his right and left respectively were Hon. Premier Fielding and Hon. Attorney-General Longley. Mr. J. E. Hardman, of Oldham, occupied the vice-chair. The first toast was "The Queen," proposed by the chairman. This was followed by "The sanctity of contracts," which was given with a ritual and highly enjoyed. Mr. Hardman proposed "The Government of Nova Scotia," to which Hon. Mr. Fielding responded. "Politics and Mining as a Fine Art," proposed by Mr. Poole, was responded to by Hon. Mr. Longley. Mr. Drysdale responded to "The Legal Fraternity," and Messrs. Harrington and Dickman to "Our Guests." Various other toasts were honored and among the speakers were Mr. T. R. Gue and Dr. McKay, of Truro. Songs were indulged in and everything passed off in a very pleasant manner.

British Columbia Colliery Returns for year 1892.

COMPANY.	Total Output to 31st Dec., 1892.	Quantity Exported.	Sold for Home Consumption.	Labor Employed.
	Tons.	Tons.	Tons.	
New Vancouver Coal Mining & Land Co. Ltd.	433,386	307,623	130,029	1,367
Wellington Colliery Co.	290,370	238,400	56,862	815
East Wellington Coal Co.	33,650	28,000	5,350	152
Union Colliery Co	68,928	66,556	4,782	520
Kamloops Coal Co.	Being opened.			8
Total	826,335	640,579	196,224	2,862

MINERAL REVENUE OF NOVA SCOVIA, 1892.

Amounts received from various sources as revenue by the Department of Mines for the year 1892, also showing a comparison with 1891.

SOURCE.	Year 1891.	Year 1892.	Increase of 1892 over 1891.	Decrease of 1892 with 1891.
Prospecting Licenses	$10,133 37	$7,371 98		$2,761 39
Rents (Gold Lease Applications)	1,622 00	1,926 00	$304 00	
Gold Rentals	1,409 50	1,653 50	244 00	
" Royalty	8,360 49	8,199 42		161 07
Licenses to Search—Minerals other than Gold and Silver	4,340 00	5,040 00	700 00	
" Work and Leases, " " "	1,600 00	1,925 00	325 00	
Rentals— " " "	2,400 00	3,030 00	630 00	
Iron Royalty		180 50	180 50	
Coal "	143,572 10	135,962 80		7,609 30
Fees, for Searchers, Registrations, etc	215 50	408 10	192 60	
	$173,652 96	$165,697 30	$2,576 10	$10,531 76

MEMO. showing the amounts received from the undernamed sources) in connection with the gold product), by the Department of Mines during years 1891 and 1892, from counties mentioned herewith.

Prospecting Licenses.

	1891	1892
Yarmouth	$127 50	$158 63
Cumberland	179 00	10 00
Victoria	351 01	341 77
King's	575 00	2 00
Queen's	1,185 18	793 64
Guysborough	1,259 89	1,892 19
Hants	1,457 01	419 74
Lunenburg	1,534 62	870 31
Halifax	1,541 73	2,375 21
Colchester	1,633 05	367 01
Other Counties.	289 38	141 48
	$10,133 37	$7,371 98

Rents (Gold Leases).

	1891	1892
Victoria	$48 00	$91 00
Lunenburg	128 00	136 00
Colchester	142 00	14 00
Queen's	142 00	92 00
Hants	196 00	154 00
Guysborough	380 00	897 00
Halifax	578 00	540 00
Other Counties	8 00	2 00
	$1,622 00	$1,926 00

Gold Rentals (Yearly Payments on Leases).

	1891	1892
Yarmouth	$33 00	$27 00
Queen's	189 00	175 50
Lunenburg	195 00	176 00
Colchester	202 50	116 00
Hants	206 50	324 50
Guysborough	236 50	313 00
Halifax	347 00	513 00
Other Counties		8 50
	$1409 50	$1,653 50

Royalty on Gold.

	1891.	1892.
Colchester	$ 6 39	$
Lunenburg	9 87	4 53
Guysborough	527 42	1,073 23
Hants	1,239 72	1,157 41
Queens	2,195 69	1,281 77
Halifax	4,381 40	4,657 08
Yarmouth		25 40
	$8,360 49	$8,199 42

MEMO. showing amounts received by the Department of Mines, Nova Scotia, during years 1891 and 1892, from various sources in connection with Minerals other than Gold and Silver, in undernamed counties:

Licenses to Search.

	1891.	1892.
Cape Breton	$1,470 00	$ 1,590 00
Cumberland	570 00	750 00
Pictou	470 00	780 00
Inverness	420 00	510 00
Antigonish	120 00	120 00
Richmond	420 00	210 00
Yarmouth		60 00
Hants, Lunenburg, Annapolis, Colchester, Digby, Victoria, Kings, Guysborough and Halifax	870 00	1,020 00
	$4,340 00	$5,040 00

Licenses to Work and Leases.

	1891.	1892.
Cumberland	$ 425 00	$ 1,025 00
Cape Breton	450 00	450 00
Pictou	375 00	75 00
Inverness	125 00	125 00
Guysborough, Victoria, Antigonish, Colchester, Richmond, and Hants	225 00	250 00
	$1,600 00	$1,925 00

Rentals—Minerals other than Gold and Silver.

	1891.	1882.
Pictou	$ 570 00	$ 750 00
Cumberland	840 00	810 00
Cape Breton	690 00	990 00
Colchester	60 00	90 00
Other Counties	240 00	390 00
	$2,400 00	$3,030 00

Coal Royalties.

	1891.	1892.
Cape Breton	$ 74,406 88	$87,994 68
Cumberland	43,042 17	20,696 54
Pictou	26,111 80	27,235 68
Other Counties	11 25	35 90
	$143,572 10	$135,962 80

Iron Royalty.

Received during 1892, from John Cameron, Esq., of East River, Pictou County, being the first Royalty from Iron received by the Department of Mines	$180 50

W. H. BROWNE,
Chief Clerk and Accountant,
Dept. Public Works and Mines.

Halifax, N.S., March 27th, 1893.

Notes of a Visit to Vancouver Island and its Coal Fields.

By JAMES ORMISTON, M.E.*

The Canadian province called British Columbia is a land of which little comparatively is known. It lies far from our country, out in the far West, and cannot be reached except by a long journey over sea and land.

For the traveller, it is a land of surpassing interest, but its time, perhaps, has not arrived yet for the settler who seeks to cultivate the soil. Fishermen and woodmen, and those who hunt the fur bearing animals, find in it a better field for their pursuits. The miners, too—colliers and gold diggers both—find occupation there; and of late the country seems to have been giving the promise of silver in great abundance stored up in its mountains.

Vancouver Island, named after the sailor who was amongst the first to navigate the waters there, forms a part of the province. It lies out in the Pacific Ocean, separated from the mainland portion of the province by the Straits of Georgia. In size it is about half the area of Scotland. In appearance it has all the natural features common to the whole of the land west of the Rocky Mountains. Nature has ploughed the earth there with deep furrows and lofty ridges, and scattered broadcast over all a crop of giant pines.

The capital of the province, the interesting little town of Victoria, is situated at the south end of Vancouver Island. Its population is about 25,000 in all, and it forms the centre of life and activity for the province. It is easily reached from the terminus of the Canadian

*Transactions Mining Institute of Scotland.

Pacific Railway on the mainland opposite, there being regular steamer communication across the dividing Straits of Georgia.

From Victoria there is a railway the only public railway of the Island and this railway connects the capital with the principal coal fields of Vancouver Island. The distance by rail to these coal fields is fully seventy miles.

The ride along this railway gives to the stranger a good idea of how the settlement of a new country proceeds. The track has been cut almost throughout its entire length in the virgin forest, and every now and again the train pulls up at a little clearing where the settlers are hard at work cutting down and burning up as useless lumber many a splendid giant of the forest. A few wooden houses, the dwellings of the settlers, are seen clustered together, a cheerful break in the gloomy monotony of the forest, and some few, but very few cultivated fields, reclaimed after many a hard day's work of patient grubbing amongst the great pine tree roots. These are the promises of life and growth amongst the youthful settlements.

The railway line terminates at the chief coal fields of the Island. The mining capital of that region, its Wishaw or Hamilton, has grown up here amongst the coal pits. The name of this town is Nanaimo (pronounced Nan-eye-mo). It has a population of seven or eight thousand, and out there where population is so scarce it is called a city.

The little city presents a remarkable contrast to the mining towns of similar size with which we are familiar at home—a contrast, it must be said, very much in its favor. Imagine a situation somewhat resembling that of Brodick or Lamlash on our own Firth of Clyde, a sunny slope looking out on the bright waters of a sheltered arm of the sea; behind this slope a high hill; and away in front, across the waters, an array of lofty mountains, the great range of the Cascades, stretched out as far as the eye can see, both north and south, their summits white with snow, and showing clear and bold against the sky, in a line fretted by many a strange curve and peak. Scattered over the waters of this arm of the sea are to be seen, also, many islands with their pine tree covering showing like a dark green mantle down to the very water line.

Although a land of coal, the sky is still clear and the air is pure, and the men who live there are free as yet from the depressing effects of the murky and grimy surroundings of our coal regions here.

The town itself is hardly in keeping with its surroundings, so far as fine palatial buildings are concerned, but as a collection of dwellings of working miners it presents a far more pleasing spectacle than anything of the kind to be seen at home.

Wood is the great material here for structures of all kinds, from lofty and elaborate churches to the rough shanties of the Indians; and for the same outlay as on a stone or brick dwelling at home, one may have twice the accommodation out there in a wooden structure, with a very presentable outside appearance, and a very fair degree of comfort inside as well.

Land, also, being of course plentiful and cheap, the houses are built for the most part each one by itself on its own plot of ground, and the unpicturesque colliers' row so familiar to us all at home has no place out there.

Some very imposing looking houses, too big, it might be, for the colliery manager at home—more the colliery owner's kind of house, perhaps—were pointed out to the writer as the property and dwellings of workingmen, and were said to have been built entirely "off the pick point."

Behind and on each side of the little town lies the deep gloomy forest, the home of panthers, bears and other wild animals. Deer, too, are plentiful in these forests, and venison is too common to be reckoned much of a delicacy.

Every miner owns a rifle, and shooting excursions in the forest are too easily had to be thought of much account

The town has a mixed population. Our own countrymen are well to the front as usual, and the writer had more than once a hearty greeting from mining men he either knew personally in the old country, or of whose people he had some acquaintance.

Life amongst the miners seems to know something more of the holiday side than amongst the same class at home, if one may judge from the means of amusement and recreation which are at hand. Pleasure boats, driving "buggies" and places of entertainment for the public are all more plentiful than one would look for from the size of the place. "Money is round and was made to roll," might be the motto of the bulk of the people. Pleasanter surroundings and a greater freedom from the nightmare of possible want seem to make them take life less sadly than at home.

The little community here has had, too, its own black times. In the cemetery behind the town one may read on the tombstones those tales of disastrous explosions in the mines, which we know of too well at home. On two occasions, a few years back, many lives had been lost in this way in the coal mines.

Measured by our home standards of population and production, Nanaimo and its mines would fill a very small corner, but to the British Columbian they have a name and fame which sound even to the far east of the wide Dominion of Canada. The visitor can be told with pride of a wandering Scot, a collier, who was making his way there, but whose tongue had somewhat lost grip of the name long before his journey had ended. All he could say was that he had come "tae houk coals at a place wi a name that soonded like My Nannieo." He required to say no more. He was set right at once, and passed on to to the proper place.

Taking up matters more technical, some idea might be given first to the extent of the island coal fields. Information on this point is by no means abundant, but certain areas have come to be mapped out in a way.

Nanaimo town is within a few miles of the southern or southeastern extremity of the field. To the north, or northwest, the field extends up by the coast for at least ninety or one hundred miles. It may extend further, but this has not yet been proved. The average width of the field is not more, perhaps than four or five miles, measured from the sea coast to the outcrop line inland.

This area has been tapped at two places, Nanaimo and neighborhood, and the Comox district, some fifty to sixty miles up the coast above Nanaimo.

The total output for the year 1891 was about one million tons, eighty per cent. or so of the whole being raised at the Nanaimo end of the field.

The age of the deposits is supposed to be cretaceous, and it needs but a slight examination of the coal-bearing strata to discover marked differences in their character, and also in their position with regard to the non-coal-bearing rocks, when compared with the older deposits of our own country. The base or floor of these coal measures is a hard igneous rock, like our whin or trap, of unknown thickness The workable beds of coal are found near the floor; indeed, the lowest seam is said to be found at times resting on the trap with nothing at all between.

In boring to prove the seams this floor becomes the index of position. The igneous rock once struck, the borer knows he need go no deeper, for sheeted whin or trap interleaved with the strata does not seem to be found there at all.

Only two seams are worked as yet, and these lie not many fathoms apart, the distance being variable, Shaley strata, with some nodular beds of clay ironstone, fill in the tale of the measures about the coals. Sandstone and shales alternately come in above, and a great thickness of these, several thousands of feet possibly, can be traced to the dip, seawards, on the islands which lie at varying distances off the shore. All these upper strata appear to be barren of workable coal. The only productive measures are those nearest the trap floor.

A distinctive rock, well known to the mining men there, is found overlying the workable coals. This rock is a conglomerate, the pebbles in it being about the size of small marbles. In thickness it seems to be very variable, changing often in part to an ordinary sandstone.

The two coal seams worked at present are of a varying thickness. It may not be very wide of the mark to give to them both an average of about five feet each of clean coal.

Shafts and ingoing eyes are both in use for working these seams.

The deepest shaft is one lately sunk on a small island out in the harbor at Nanaimo. This shaft tapped the lowest workable seam at a depth of one hundred and twenty fathoms, and a well equipped colliery, capable of raising a large output, is now in process of completion at that spot.

In the methods of working the coal there does not seem much to call for special remark. Neither water nor firedamp appears to give them so much trouble as at home. The two bad explosions referred to were more likely due to coal dust than to gas. A very elaborate system of water pipes is in use at one colliery now to lay the dust and lessen the risk of explosion from this source.

At one of the mines electrical coal cutters are being tried, and at another electrical locomotives for haulage underground. In neither case, however, had there been a sufficiently long trial to enable much to be said about them. This indicates, however, that even in the farthest West the use of electricity is pushing its way.

The quality of the coal is not so good as that of our home coal. The ash runs up to about double the amount of that of our average quality of coals, and the fixed carbon for the most part runs too low to make a very good steam coal. At the Union mines, in the Comox district, the coal is in some respects better than at Nanaimo, the ash is perhaps no lower, but the fixed carbon is higher, and the caking property is much better developed there than in the Nanaimo coal.

Good firm coke was being made in an experimental oven from the washed small of this Comox coal. The ash of this coke, however, would be too high to enable it to hold its own very successfully with such a coke as that of Durham or Pennsylvania, it being about 18 per cent. in quantity.

The nearness of great bodies of igneous rock to the coal seams does not seem to be accompanied here by the same charring or burning of the coal as we find at home.

At no place does anthracite or blind coal seem to have been found on the Island, not even where the coal has the trap rock for a pavement. One naturally infers from this that these sedimentary coal bearing rocks, with their coal seams as well, had been washed down and deposited on the trap rock floor after the latter had become cooled down. The variations observable in the fixed carbon of the coals are possibly due to varying pressures, either lateral or superincumbent. The Comox coal has the highest fixed carbon, and the mines there are close to a high mountain range; an upheaval probably dating long after the coal seams had been deposited. This upheaval may have produced a lateral pressure sufficient to work the change in the character of the coal, as pressure and direct heating appear in many cases to be followed by the same results. Round Nanaimo, on the other hand, there is a comparatively large area of the coal field beneath a plain more or less flat and at some little distance from the hills.

Coal deposits thought to be of similar age to those of Vancouver Island have been discovered in the Queen Charlotte group of islands, about 150 miles to the northwest. Some of this coal is reported to have been found in the anthracite condition. The writer was shown one specimen from there supposed to be anthracite coal. A simple blowpipe test, however, showed it to be a piece of obsidian or natural glass, a volcanic product destitute of carbon, but possessed of a fracture black and lustrous, not unlike that of anthracite coal.

The north end of Vancouver Island has shown signs of coal, indeed a small quantity was worked there many years ago; but the seams found there were two thin for profitable working. The district, however, has been having renewed attention from coal prospectors of late.

The interior of the Island is almost entirely an unknown land as yet. This may sound strange to people at home, but it will not be a matter of much surprise to the man who knows something of the dense forests of that region. The Island is one great forest, and a march of a few miles in this forest where no trail has been made will prove a good day's work for a strong man.

It is something curious to note the remarkable persistency of growth in these great pines, even in the most unlikely spots.

The crests of the mountain ranges six thousand or seven thousand feet high, show a bristling line of pine trees against the sky, and from these crests down to the water's edge at the sea line, there stretches out one dark green forest sheet, broken only, it may be, by the gorges of the rivers or the smooth shining surface of the mountain lakes.

The great Douglas pine, the commonest tree of these forests, has a height more often, perhaps, over than under 150 feet, and very often it is much over 200 feet. The cedar, too, of these forests is another great giant. This is the tree the Indians choose for their dug out canoes. One of their large family or tribal canoes, seen by the writer and roughly measured by him, would be somewhere about forty or fifty feet in length, by about six feet beam, cut out of a single cedar trunk.

These Indians, the original lords of all these lands, form a subject of much interest to the traveller. In the earlier days of the coal mining their labor was in use at the mines, even for underground work, but now they are all back to their original work of fishing and the cultivation of their little gardens.

For work at the mines, the yellow-skinned man from the other side of the Pacific Ocean has appeared on the scene, and he has driven the Indian out of the field. Large numbers of these Orientals—Chinese and Japanese both, but particularly Chinese—are employed for nearly all kinds of work at the mines.

It looks rather peculiar, at first, to see these pig-tailed fellows tipping up hutches and doing all the work about a busy pit-head as expertly as if they had never done anything else in their lives. More peculiar still, perhaps, to meet them underground, handling with perfect skill all the tools of the collier.

The manager of one of the mines, a Lanarkshire man, spoke well of the Chinaman as a good all round colliery man, and both biddable and reliable to the bargain.

The Provincial Legislature of British Columbia some time ago passed an act to exclude the Chinese from all work underground, but for some reason this Act has not been enforced. A case of infringement of the Act had been attempted to be raised, the writer was informed, but it broke down, and the alleged reason for the break down was rather remarkable. The Chinamen accused of breach of the Act pled not guilty, and this was not on the score that they hadn't been working underground, but from the fact that they weren't Chinamen at all. They came from Hong Kong, they said, and were goods subjects of Queen Victoria. Hong Kong being a British possession, and the tracing of a Chinaman's genealogy and birthplace being a "kittle" job for a Western man to tackle, it seems little wonder that the case for the prosecution after this was left alone.

But the Chinaman's presence out there, it is to be feared, gives to the workingmen of our own race, rightly or wrongly, much occasion to blaspheme. From no other country under the sun could such competitors for the work of the white laboring man be drawn as from China. Viewed as a mere engine to effect a cheaper production, the Chinaman, when skilfully directed, may well be a terror to the manual workers of any other race. We are hearing much in these days of the doctrine that every penny of our wealth is the creation solely and entirely of the class which supplies the manual labor. Should the discord between classes, due to the preaching of this doctrine, ever unhappily lead to extremes, the Chinamen in that case may prove an object lesson to help on a somewhat modified belief in the doctrine. China, roused from slumber and ready to join western skill and western capital to her own vast resources, might work many a queer change under free trade in the industrial world.

Meantime, however, one may note with interest how the Chinaman can calmly take his place beside the white workman heedless of all opposition so long as it takes not the shape of physical violence, and how, while imitating closely his white brother in all that pertains to the work in hand, his imitation sharply ceases when this work is done. He becomes the elder brother then in all other respects, conscious of superiority, differing in this matter from that docile child of the human race, the African negro, with a difference wide as the poles.

Quite a considerable proportion of the whole work of the coal mines out there is done by Chinamen, and unless the present poll tax is increased this proportion will doubtless grow larger. White labor of all kinds is very highly paid, more than double the home scale in many cases.

The cost of living, so far as food goes, does not differ

much from the home cost. Housing, in the sight of wooden buildings, will be even less in its cost than at home. Clothing of course is higher, as it must be brought either from the old country or from the distant provinces of eastern Canada.

The man who wishes to live economically out there would require, however, to do with as little as possible in the way of service from people of the white races. The Chinaman has been sharp enough to see his opportunity here, and has established himself as the general laundryman, cook, and even housemaid of the community.

As illustrating in one small item how the personal services of the white man must be paid, the writer may mention his having to pay in Nanaimo the sum of two shillings for the simple ten minutes service of the hairdresser.

The climate of Vancouver Island is very pleasant. The summers are brighter and warmer than with us, and the winters don't appear to be any colder. Plenty of rain no doubt falls, but the proportion of bright sunshiny days appears to be much higher than ours. Altogether, for climate and scenery, it is such a land as the man of this country is likely to find pleasant and agreeable.

The future prospects of the coal mining of the island have had no notice; perhaps something said on this point will be of interest.

The area of coal-field already proved is considerable, and it may be that as the island is better explored other areas will be found. In any case, there seems to be coal-field enough to supply the demand for a long time to come.

The demand at present is mainly from San Francisco, the chief city of the whole Pacific coast of North America. San Francisco draws a fuel supply from countries widely scattered. Australia supplies a large quantity, and so does our own country. When the outward freights of the port are tempting enough, sailing ships in large numbers, carrying coal at nominal freight, come from round the Horn and from the Southern Pacific, and then San Francisco becomes flooded with cheap coal, of a better kind, too, than any mined on the Pacific coast. These are bad times then for Nanaimo, and they appear to come too, rather frequently. Still, leaving this out of account, the Vancouver coal seems able to do more than hold its own with any other coals raised on the Pacific coast. In the State of Washington, to the south, a good deal of coal mining is carried on amongst deposits which appear to be a continuation of those of Vancouver Island, but this coal for the most part seems to have more of the lignite character than any other.

The market is bound to grow as population grows; and as iron ore seems so be abundant also, it may be that a local iron trade will come in by and by to increase the local demand for coal.

One remarkable feature of this region is the great extent of country opened up both in Vancouver and on the mainland by canal-like arms of the sea, deep enough to float the biggest ships. Both the coal and the iron ore deposits and, it may be added, great limestone deposits as well, are all convenient to these deep water channels. Some day these channels will doubtless play an important part in the ready in gathering of produce of all kinds.

CANADIAN COMPANIES.

The Van Winkle Consolidated Hydraulic Mining Co.—The annual general meeting of the Van Winkle Consolidated Hydraulic Mining Company, Limited, was held on 4th instant at the Company's office, Vancouver, the President Mr. R. G. Tatlow occupying the chair. The following report on the operations at the Company's mining locations was presented by the President:

VANCOUVER, April 4th, 1893.

To the Shareholders Van Winkle Consolidated Hydraulic Mining Co., Ltd.

GENTLEMEN,—It must be a matter of greatest disappointment to you as it is to your Directors that, owing to the exceptional, I may say almost unprecedented, lateness and severity of the season, active operations have not yet been commenced upon the Company's Mining locations. However, you will be glad to learn that, from very recent reports, there is every prospect of an immediate thaw, and already 250 inches of water are reported from Last Chance Creek.

The lateness of the season, I am happy to say, is not as irreparable an evil as at first appears. Your manager, Mr. Holland, being on the ground early in February, spent his time in constructing a flume to carry waste water on to the ground to be washed, thus enabling us to commence operations this season with 1,500 inches of running water in addition to the 900 inches carried by the pipe, which Mr. Hobson considers should enable us to handle over 5,000 cubic yards per diem.

The report from Mr. Holland will prove of interest to all, but especially in two particulars:

First.—As to the run last fall of 53 hours and 25 minutes, during which 5,000 cubic yards were handled, viz., over 2,000 yards per diem. When you consider that this was done with 600 inches of water and great care had to be exercised to form a lip where the bench was first opened, there can be little doubt as to the practicability of moving the large bodies of gravel by hydraulic means, on the success of which our enterprise depends.

Second—The fact of gold having been found in the sluices of last fall's washing (when as you are aware we had hardly penetrated through the under strata to the pay streak) proves that gold exists in that large body of gravel, which, not having reached with our prospecting shafts, we had calculated upon as being non-productive.

With regard to the economy of your works I have only to ask you to remember that the total amount realized from sale of stock to date is $19,000, of which there is still on hand $1,767 04, out of which will have to be paid accounts amounting to some $750, leaving in hand $1,000 to meet the pay sheet for last month. In other words the mine starts the 1st of April in perfect working order, equipped in every detail and clear of all debt.

Whether you will wait until May 1st before making any further financial arrangements, or will place say 500 or 1,000 shares of stock on the market at once, remains for you to decide.

Yours truly,
R. G. TATLOW,
President.

The election of officers then took place and resulted in the re-election of the old Board, the personnel of which is as follows: President, R. G. Tatlow; Vice-President, J. M. Buxton; Directors, George de Wolf, E. Mahon, and H. T. Ceperley.

The meeting then adjourned.

The Wright Cement Co., (Ltd.)—gives notice of application of incorporation under Dominion Statutes. Authorized Capital, $250,000, in shares of $100. Head office: Hull Que. Directors: C. B. Wright, Ruggles Wright, and C. M. Wright, Hull, Que; Hector McRae and W. J. Campbell, Ottawa. Formed to purchase the business carried on under the name of C. B. Wright & Sons, at Hull, Que., as manufacturers of brick, tiles, drainpipes, plaster of paris, hydraulic cements, etc.

Stanstead Granite Co., (Ltd.)—This company is applying for Dominion charter to acquire and work granite or other quarries in the Dominon of Canada. Capital, $100,000, in shares of $100. Head office: Stanstead Junction, Que. Directors: Hugh W. Elder, John W. Elder, and Jean B. Fregeau, of Beebe Plain, Que.

The Kookagamaming Gold Mining Co., of Ont., (Ltd.)—is the name of a new company seeking incorporation under Ontario Statutes. Capital, $200,000, in 40,000 shares of $5.00. Head office: Toronto. Directors: David Hunter, W. H. Cathro, G. L. Macdonald, Henry Lemon, A. G. Lundlack. Formed to explore for and mine minerals and ores in Ontario. Operations to be carried on in the district of Nipissing.

Rat Portage Mining Co.,—is applying for Ontario charter, to carry on the business of a mining and reduction company, in the district of Rainy River and Thunder Bay. Head office: Rat Portage, Ont. Capital $3,000,000. Directors: E. Wilber Barnes, Albert J. Upten, and A. C. Boyce, Rat Portage Ont.

The Holmes Fibre Graphite Co.,—is applying for Ontario charter Capital, $250,000, in shares of $100 each. Directors: Dugald Graham, Fred Fairman, and Wilson Fairman, of Montreal. Head office: Toronto. Formed to manufacture fibre graphite bearings.

The Duluth and Saint Paul Mining Co. (Ltd.) was registered under the Foreign Companies' Act, at Victoria, B.C., on 8th February. Capital, $2,000,000. Head office: Ainsworth, B.C.

Spokane and Great Northern Mining Co., (Ltd.)—was registered at Victoria B.C., under the Foreign Companies' Act, 2nd February, 1893. Capital, $5,000,000. Head office: 104 Yates Street, Victoria, BC.

Freddie Lee Mining Co.,—has been registered at Victoria, B.C., under the Foreign Companies' Act, 23 March, 1893. Capital, $500,000, Head office: Kaslo, B.C.

Bell's Asbestos Company, (Ltd.)—The general meeting of the shareholders in this company was held at the Cannon Street Hotel, London, England, on Monday, 9th March, Mr. John Bell in the chair.

THE SECRETARY (Mr. G. W. Giles) read the notice convening the meeting.

THE CHAIRMAN, in rising to propose the adoption of the report and balance-sheet, said: The year to which this report and balance-sheet refers is one of a series of three years in which it has been exceedingly difficult to make money, and the last of the three years has been the worst of them. Nearly all the trades upon which we depend for our business are in a deplorable state of depression. Everywhere we are asked to made the cheapest possible things, because everybody wishes to curtail outlay. The suffering in trade seems to have been greater on the Continent, amongst the manufacturers of asbestos goods, even than with ourselves, and those of them who took sanguine views in 1890 stocked themselves very heavily with crude asbestos, and with forward contracts for further supplies, and the result has been that during the past year we have practically done no business in crude asbestos. You will recollect that this time last year I told you we had to carry over from the previous year a considerable quantity of our contracts, and, practically, those contracts which we have carried over have constituted our trade in crude asbestos; so, whilst we have been able to maintain our position as regards manufactured goods, and even slightly to improve the profits on that part of our business beyond that of the previous year, there has been a very great falling off in the sale of crude asbestos from the mines. Whilst dealing with the matter of the asbestos mines, you will recollect a year ago I told you we had two law-suits—one, in which we were plaintiffs, to defend our boundary line against trespass, and the other, in which we were defendants, contending for a boundary line which we believe to be ours, and which is disputed by our neighbors. The first decision with regard to that boundary line was given against us. We appealed, and another decision has been given against us and for us—against us as regards the boundary line, but, strange to say, in favor of us in the reduction of the damages that we were to pay. We were condemned before to pay $7,000 and the court has reduced those damages by $4,000, making the amount of damages we were condemned to pay about £600, and the parties who gained the point with regard to the boundary line have been condemned to pay costs. I do not understand a decision of that kind; but we have appealed against that decision to the Superior Court of Canada, and I hope it will be settled during the year. In the other suit we have against a person with regard to trespass upon our boundary, no decision has yet been arrived at. On the other side of the accounts you will notice, notwithstanding a shrinkage in business, that we have an increased amount of bills payable and open accounts. Our present indebtedness at the end of the year is greater than it was at the same time last year. That is entirely accounted for by the fact that the new buildings were made ready for occupation at the end of the year, and that there were large accounts to be settled at that time, and they are now in the course of settlement. We have purchased the freehold of our premises at a cost of £25,000, which sum of money we have raised by mortgage at 4 per cent. All the expenses connected with these buildings are included in the cost of £49,956, and we write off annually 2½ per cent., which is the usual thing with regard to freehold buildings. One more point in the report is that the time has come for myself to be proposed for re-election as a director of this company. It is provided in the articles of association that I should serve the company as chairman for five years; those five years have now expired, and my re-election will be submitted to you in the usual course at the end of the meeting. I should not be out of order, I think, in alluding to what has been accomplished during those five years—I do not mean to say accomplished by myself, but accomplished by the careful consideration which the directors have always given to the subject under their care, and by the assiduity of the managing directors and staffs that serve under them. During that time we have paid off rather more than £9,000 debentures, created a reserve fund of £30,000—£15,000 of which has been out of the ordinary trade profits of the Company—and we have distributed, including the dividend we propose for consideration to-day, £84,000 in dividends. I think that out of the five years—three have been years of great commercial depression, increasing since 1891—we have a fair record to show. I shall not occupy your time longer, but will now propose the resolution, which is, "That the report of the board of directors and of the auditors, and the financial statement submitted to this meeting for the year ending December 31st, 1892, be, and the same are hereby, approved and confirmed."

MR. H. HEYWOOD seconded the motion.

The resolution was unanimously agreed to.

THE CHAIRMAN then moved:—"That this meeting sanctions and approves the payment of a dividend of 5s. per share, free of income tax, payable on March 18th, 1893."

MR. A. J. BURNETT seconded the motion, which was unanimously agreed to.

MR. H. HEYWOOD proposed, and Mr. T. B. Lightfoot seconded, that Mr. John Bell be, and is hereby, elected a member of the board.

This concluded the business of the meeting.

The Horse Fly Hydraulic Mining Co., (Ltd.) gives notice of application for charter under the Companies Act, British Columbia. The objects of the Company are to take over and acquire mining leases or claims in the Province, and to carry on the business of hydraulic or other processes of mining. Authorized capital, $200,000 in shares of $10. Head office, Vancouver, B.C. Directors: Harry Abbot, W. F. Salsbury, and John M. Browning.

The Acadia Coal and Coke Co. is applying for incorporation in the Province of New Brunswick, for the purpose of acquiring real estate, minerals and mining property, mining coal, quarrying stone, manufacturing coke, and all kinds of brick, tiling and earthen pipe, shipping and selling all of the above mentioned articles, building works and erecting buildings and all other things which may be necessary or incidental to the business of coal mining, operating or trading. Authorized Capital, $1,000,000, divided into 12,500 shares of $100 each. To consist of two classes of stock, namely:—*A* stock, being the ordinary stock of the Company, to the amount of nine hundred and [illegible]

thousand five hundred shares of one hundred dollars each; *B* stock, being preference stock, having preference right of dividend over ordinary stock, at eight per centum per annum annually to the amount of three hundred thousand dollars, divided into three thousand shares of one hundred dollars each. The Directors are: John W. Lowe, Stonehaven, N.B.; George R. Sangster, Moncton, N.B.; W. T. Whitehead, Fredericton, N.B.; F. P. Thompson, Fredericton, N.B.; John W. Y. Smith, Dorchester, N.B.

Boston and Nova Scotia Coal Co.. (Ltd.) This is the name of a new syndicate which is seeking an Act of Incorporation from the legislature of Nova Scotia. Some difficulty has been experienced in getting at the actual facts, and at present we must defer from going into detail until more information is available. The authorized capital is $1,000,000. The applicants include the Hon. W. Chandler, and J. C. Cobb, Boston; David S. Baker, Providence, R.I.; W. J. Fraser, Halifax; A. C. Ross, North Sydney, C.B.; R. P. Fraser, New Glasgow; P. O. Mullin, Halifax; John McKeen, Mabou, C.B. The special object of the company is to acquire and work the Broad Cove coal areas, Inverness county, C.B., and the construction of a line of railway from Broad Cove to Orangedale and thence to Caribou Cove at the mouth of the Straits of Canso.

The Standard Coal Company is the name of another coal company seeking incorporation by Act of the Legislature of Nova Scotia, for the purpose of operating the Shannon areas at Port Hood, C.B.

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 boundry 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 laid 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 chemical 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 11,000 tons about.

NOTE—I consider the present depression only a temporary one, and that there is a future 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.

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 was used at 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.

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 industry

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 Laurentian 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 more.

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 Gaspe 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 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 that 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.		15,491¼ "
Phosphate	do		*29,060 "
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 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. —Editor CANADIAN MINING REVIEW.]

‖From Eastern Townships.

‡From Montreal, principally from this province.

QUARTERLY GENERAL MEETING

OF THE

General Mining Association

Of the Province of Quebec.

The Spring Quarterly General Meeting of the General Mining Association of the Province of Quebec, 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; Theo. 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; and* 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 10½ a.m. The Hon. George Irvine, Q.C., President of the Association, owing to an unfortunate fatal illness in his family, was unable to be present, and Capt. R. C. Adams, was called to the chair.

The Duty on Mining Machinery.

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, Controller of Customs at Ottawa, on Wednesday, 9th March. We were given a courteous hearing and the Controller 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. A full stenographic report of the interview was taken and perhaps it might be interesting to have it read. 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 forming purposes? Blast furnaces and gold mills and metallurgical works are manufacturing interests co-related with mining, but according to the definition of the Act, are excluded from free imports of machinery. For instance here is a point in question that has been brought to my notice by Mr. McDougall of St. Hyacinthe, who is projecting a new plant for the manufacture of peat fuel.

(Letter read).

MR. S. P. FRANCHOT read the stenographer's report of the interview, 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 Block-hole 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 specifications 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 operators 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 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.

MR. F. CIRKEL (Templeton)—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 its 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 larg. 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 sheats. Mica crystals frequently line drusy cavities in fissures; they preserve in this mode their sharpness of outline, and are for the most part not contorted. Their regularity and frequently large dimensions serve to distinguish them from the crystals of the other mode 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 different modes, as single imbedded 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, veinlike 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 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 laminaes 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 proofed 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 by different mines in the Templeton and Wakefield deposits. In these mines valuable deposits have been found in a depth of 150 till 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 genesis 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 laminaes 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 " "
1,500 lbs., 2 x 3 " "

or altogether about 30 per cent.

The Industrial Uses of Mica.

MR. B T. A. BELL—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 scurces as were at hand, a few features of the mica industry which I have thought might be useful in supplementing the papers presented today 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 mining 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 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 the 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 much 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 blocks 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 some years the business was carried on quietly.

Mica 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 lbs. of a total value $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 lbs. of a value of $7,000. The average depth of them ines 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 lbs., 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 lbs., 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 lb.; 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 lbs., was valued at $75,000; in 1891 it had increased to 75,000 lbs., 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 the following figures quoted from the returns of the Geological Survey of Canada. 1886, $29,008; 1887, $29,810; 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 1876 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 pasting it upon a hard surface and splitting it off as much as possible, the remaining fragments are so thin as to become beautifully iridescent. The builders of armatures can therefore split the sheets into any desired and uniform thickness with great ease and accuracy. An interesting 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 cylinderical. 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 required by mica was the last to yield. Therefore it was proposed to build the armature primarily with mica.

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 x 4 in., 1¼ x 6⅝, 1⅜ 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—In a paper read this year before the American Institute of Electrical Engineers, a Mr. Thompson describes the use for insulation of pulverized or comminuted mica mixed with a liquid cement and rolled or compressed in various forms known as Micanite. Mr. Thompson says: "Although so 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 objectionable, 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 difficult.

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 article 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 in 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 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 procelain 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. A visit to the works of the Railroad Mica Lubricating Company at Denver, Colorado, is thus described.

The mica comes to the factory in carloads, just as it is taken from the mine. It is fed by boys into two machines, which cut it into fragments about half an inch in size. By a system of pneumatic tubes, the mica, so cut, is delivered to the atomizing machines, which grind it into powder.

These machines one must see to fully realize their peculiar action and construction. Each machine consists of two steel shafts three feet long, with a series of gun metal spirally arranged beaters, which revolve in a closed case forming a figure. When in operation these machines make from 5,000 to 7,000 revolutions in a minute. The beaters on the revolving shafts are so arranged that the fingers on one pass between the fingers on the other shaft, so that when the material is passed through the pneumatic tubes from the feeding machine to the atomizers at a velocity of 15,000 feet a minute, the work of atomizing is instantaneous.

The mica, now reduced to atoms, continues its course at the same velocity through another set of pneumatic tubes to the sifting bins. Here the current is so retarded by the peculiar mechanism that it causes the material to settle in the various compartments, of which there are six, at the same time grading the material according to its fineness. The powdered mica is now settled in the hoppers or bins, immediately over the mixing pans. Here the several grades are drawn into the pans, which are provided with mechanical mixers, and the lubricant is made up by the use of the proper percentage of oils, mica and such other ingredients as the company uses in the manufacture of the product.

Directly over the hoppers are located the oil-tanks, which supply the mixers by a pipe running down on the outside of the hopper, on the end of which is a faucet.

At the south end of the bins there is located a large cylindrical machine four feet in diameter and ten feet high, that is called a dust arrester. Any of the material that is so light and fine that it will not settle is driven into this machine by air currents, which thoroughly separate the mica dust from the air, where it settles in the bottom of the machine and is drawn off as needed

It is stated that the capacity of machinery heretofore made for pulverizing mica has been from 300 to 400 pounds a day, and then the material has not been sufficiently fine for lubricating purposes. It is claimed for this new concern that it can pulverize about five tons a day, or in ten hours running."

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.

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 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 phosphate 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, but as the revised notes of what he said have not been returned up to the hour of going to press, they are withheld until our next issue.

The following paper, by Mr. J. Bawden, of Kingston, was read by the Secretary :—

The Iron Ores of Frontenac and Leeds, Ontario.

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 1874-5, 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 occurences 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 occurences 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.

Loughboro'—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 Concession 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 Concession 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 Concession 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 6th 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 Concessions, 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 Concession. 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 analysis) :—

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 Concession with syenite footwall, greenstone hanging wall, the ore had the following average composition :—

Fe	62.03
Al	1.22
Si	2.56
Cao	1.17
Mgo	1.72
Mngo	.63
S	.273
P	.0149
Ti	.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 titanferous ores open up when heated to redness and thrown into water, 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 nonferriferous. 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 Palmerston. 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	1.03
Insol	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 predicate 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 manufactures 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 inquiry for dense refractory ores carrying sulphur, or phosphorus, or titanium, above objectionable points.

Peat Fuel.

MR. T. W. GIBSON, (Toronto)—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 in thickness 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 headwaters 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 is especially 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 pasty 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 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 pasty, 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 unfrequently 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 gives 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 reduction 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 Buestrode, 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 a sample 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, 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 to $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 desiccation 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 in through the roof by means of a fan, made to descend through the peat, and thence to 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 intoduced 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 exhaustive 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 suitability 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 relatively high, and that as regards Great Britain, circumstances must greatly change before these favorable conditions for utilizing peat are fulfilled. Percy's convictions 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 the 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 be 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 Industry of Canada.

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 interest 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 furnace 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 Gaspè 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 being about 700 miles by rail, while the great areas of Pictou 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 hard 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 utilization of our peat bogs we must, however, bear in mind the fact 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 indurstry 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 these 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 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 at 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 Bleu, 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 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 Arthabasca to the St Lawrence opposite Three Rivers, at Bulstradge, 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 these 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, Daquame, 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 sphagum, 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 stem and rootlets, help to swell the organic constituents of the moss. In bogs of a good depth the peat may be divivided 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 in 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 rapest 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 surface 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 purest 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 shew, 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 suitability 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, nor 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 first 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 the 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 it 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 peat 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 and brown color and earthy fracture 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 shewed the ratio of peat to this fuel to be as 1 to 2.25 and a table prepared by Prof. Johnston, showing the comparative composition and quality of peat, wood and anthracite is as follows:—

	Carbon.	hyd.	ox. & nit.	ash.	water.	sp. par.
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 the 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 Vignolis process, in which the carbonization was effected by means of superheated 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 Chailleton 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, with 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	14.97
Volatile combustible matter	60.10	59.10	59.60
Fixed carbon	21.80	22.60	22.20
Ash	3.28	3.30	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	17.31	17.06
Volatile combustible matter	49.80	51.65	50.72
Fixed carbon	29.90	25.00	25 95
Ash	6,50	6.03	6.25

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 quality for fuel purposes, and thus shows that in the attempt to place this industry on 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 com-

pressed 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 the statements contained in Brughat's treatise, as well as those obtained from the manufacture 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 peat 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.

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—Is 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 simply 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.

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 proceeding 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 that 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 fact. 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 Prospectors 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."

The evening's entertainment of song and sentiment was contributed to by a number of gentlemen present.