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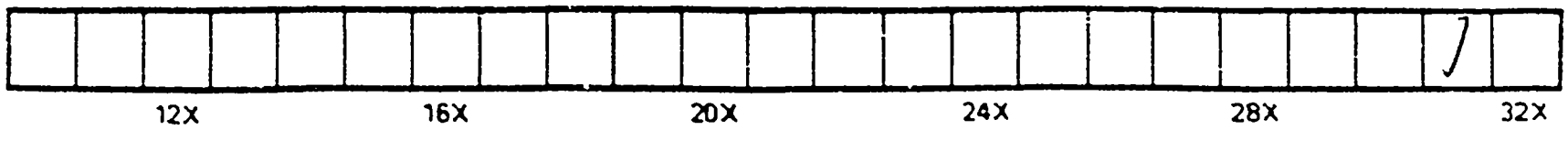

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Established 1882

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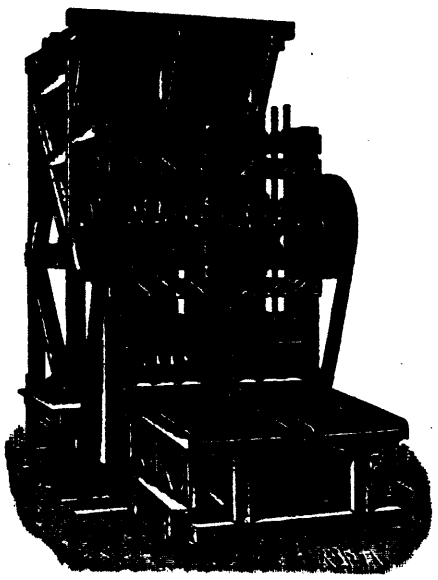

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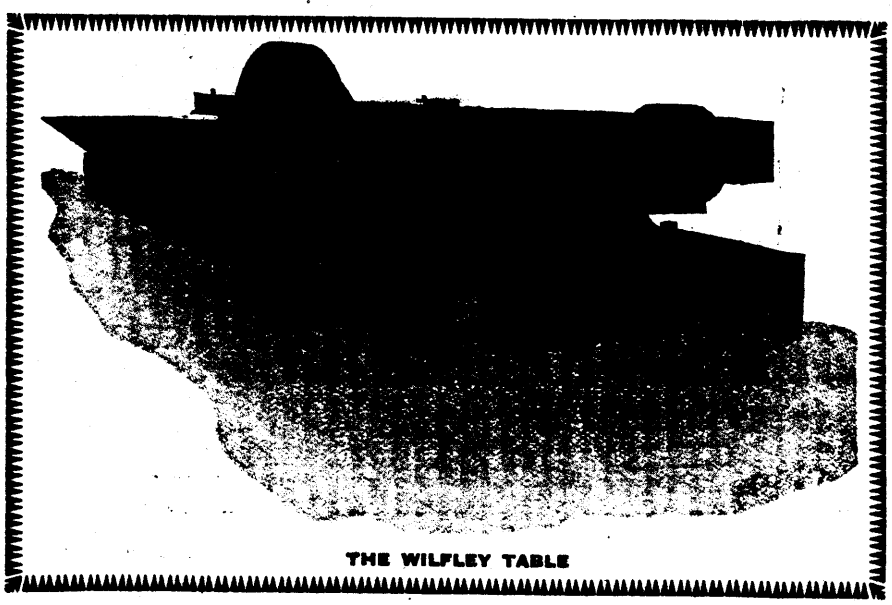

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VOL. XXII., No. 3. MARCH, 1903. VOL. XXII., No. 3.

Another!

Another graphite prospectus calls for notice. The artist, whose free, generous treatment of his subject reminds us of our friend of the Empire Mica idyl, requests, his readers to "eliminate from their minds every other variety of mining enterprise," as a preparation for the event of the Grenville Graphite Company into their consciousness; "for," he writes, (and we could laugh if it were not that so many foolish people will be found to listen to the voice of the siren) "this graphite mine is not to be compared with gold, silver, and copper mines." He has in his mind's eye the suspicious reception of his rosy picture by those who have invested before on the strength of his high falutin representations. "It is not a mining proposition,"—he actually stumbles on the truth,—"it is *lying* exposed,"—quite correct, and we shall proceed to expose it further so that he that runs may read; and guideless reader, "when you have seen that the Grenville Graphite Company will be in a position, within a very few month, to control the American graphite market," it will be quite soon enough to buy a few million shares.

This marvellous exhibition of the longbow opens with a paragraph which is so rich that we quote it pretty fully so that our mining friends may laugh.

"There are only two graphite mines in the world. These two deposits measure the visible supply of one of the most important minerals used in commerce, in the arts and sciences. One of the two deposits is owned and worked by the natives of the Island of Ceylon, in Asia, and until a very recent day it was supposed that graphite mining must always be confined to this celebrated deposit.—The most energetic prospecting for many years in all quarters of the globe has failed to reveal any other deposit of the mineral which it would pay to work. . . (*This is discouraging for our friends of the Black Donald*). The second of the world's great graphite deposits, located (*Of course*!) at Grenville, Canada, is about to be opened up on a scale which, *in a few months*, (Italics ours) will surpass the operations in the famous Ceylon graphite mine."

As a matter of fact Ceylon is producing less than one half of the world's supply of graphite, —in 1899 (the statistics nearest at hand) 32,067 metric tons out of a total of 83,928 metric tons. Austria produced in the same year, 31,819 metric tons. In 1902 the United States produced about 2,000 tons of crystalline and 1,300 tons of amorphous graphite. Italy and Germany are also large producers. Then there is the artificial graphite being made in large quantities at Niagara Falls by the Acheson process, and acknowledged to be a formidable competitor in "electrical work," although our prospectus-maker assures the investor that "no substitute has ever been discovered which will perform its office, nor is there likely to be found a material which will take its place," i.e. the place of material graphite. He also lets out incidentally the trade secret that graphite is used "to give rubber its flexibility."

Mr. H. P. H. Brumell, at one time an assistant in the statistical branch of the Geological Survey of Canada, has incautiously put himself into the hands of the boomster by his singular methods of computing ore exposed on the surface as "ore available," which he calculates as 900,000 tons, although his description implies that the ore is not "in sight" in the sense of being blocked out.

In the absence of this, as is well known, there is no certainty about the contents of the deposit; and it is very much to be regretted that a former official of the Geological Survey should have laid himself open to question by this loose method of computation. He has however been cautious enough to declare the impracticability of estimating the value of the other veins on the property. But W. J. P. Williams, mining expert, whoever he may be, sees him and goes him five better! Under his magic touch the modest 900,000 tons expand into 6,600,000! And with this as a basis he easily calculates that the net profits of the company *should be* $165,000,000 on the ore *now known to be available (!!!)*. This veracious mining expert also informs us that the mine at Grenville "is the only graphite mine on this continent," and that "there is nothing possible in the way of increasing production" Is it any wonder that we have reached the present accepted definition and classification of *mining expert?* Place this statement of Williams beside the fact that five of the States to the south of us are now producing graphite and that graphite properties are being developed in five others.

But this, like all fake prospectuses, needs only to be read to be condemned. The wonder is that anybody is deceived by such glaring absurdities and contradictions. For example, Mr. Brumell's report (p. 10) gives 15% as a conservative estimate of the content of the ore. When we reach p. 18 this has grown to 25% (also called a conservative estimate), and by the time we arrive at p. 20 there are "1,600,000 tons of pure graphite blocked out." Truly, as we are told on the next page "this is *not* a mining proposition," "it is *lying exposed*," and "the figures given are ultra conservative, so made in order that the Company may not be thought to be making extravagant promises." Not at all! A promise of 25% dividends on the capitalization at $4,000,000 of a partly developed prospect! This can hardly be called extravagant. It transcends such a commonplace adjective! It should rather be

described as colossal lying. By the way there is surely a slight inaccuracy in the cable address, *Grengraph*, it should have been *Greengraft*.

That legitimate mining enterprise should have to endure this sort of thing is one of the puzzles. Here is a prospectus the very terms of which show that it is a crude, vulgar scheme to extract a large sum of money from the unwary small investors of Canada and the United States. It is "*not* a mining proposition," but a stock-selling enterprise. There may be, and probably is, a workable deposit of graphite at Grenville; but it is in a fair way to be brought into disrepute by the unscrupulous methods of the promoters of the Grenville Graphite Company; and thus investment in legitimate mining will be once more discouraged. Investors should know that the method of the Grenville Graphite Company and their like is *not* "the usual and only way" to developed a prospect, although it is too common a way by which conscienceless promoters line their pockets at the expense of the investors.

As a final example of the misrepresentations to be found in this precious document let us set down here a little of the history of the Grenville graphite deposits, to be read in the light of the prospectus, which tries to give the impression that the discovery is a comparatively recent one. Logan noted it in the Roport of Geological Survey for 1845-46, so that our knowledge of it extends back more than fifty years! It was worked and abandoned at various times. In 1876 it is reported as having been opened to a depth of thirty feet along sixty feet of its course, and some of the graphite had been exported. Osann (Geological Survey Report, 1902) describes it as follows. "The graphite which is worth mining occurs in the limestone as undoubted filling of fissures and veins, which occurs together locally with almost parallel strike. Few of those veins are more than 1 decim. (3¾ inches) in thickness. The limestone between the graphite veins is very much altered, and particularly rich in quartz. . . . At the same time there has occurred a strong impregnation of graphite, so that in the neighbourhood of the cracks *the rock has become almost black?* Contrast this with the boomster's 1,500,000 tons of solid graphite and judge whether it is time to buy a million shares or so in the Greengraft Graphite Company.

A Few Suggestions on Mineral Statistics.

By Eugene Coste, M.E., Toronto.

Before offering the following suggestions on "Mineral Statistics" I suppose I have first to plead guilty for the introduction (in the two first statistical reports of our Geological Survey, in 1886 and 1887) of the very system, or rather want of system, which I am now about to criticize, as I have felt for some time that it could be much improved to the great advantage of our mining and metallurgical industries. Being human we are, of course, all liable to errors, even in our best efforts, but false pride should never prevent us from endeavoring to rectify and improve even, if in so doing, we have to acknowledge mistakes of the past. Acting on this principle I am willing to do my best towards this rectification, but it can only now, on my part, take the form of suggestions, since I have long ago resigned my former position of Mining Engineer of the Geological Survey.

Clearness is the essential point of all good statistics; it is even paramount to absolute accuracy which often cannot be obtained, especially in this case of voluntarily mineral statistics collected by the Geological Survey or even when collected with more power of law, by our Provincial Mining Bureaus. But no matter how accurate statistics may be they will loose most of their value if they do not deal in the same tables, with clearly defined units of the same class and character. If, for instance, we add in a statistical table the value of wheat with the value of bread it is quite certain that we obtain a sum which really means nothing, as it neither represents the wheat nor the bread production.

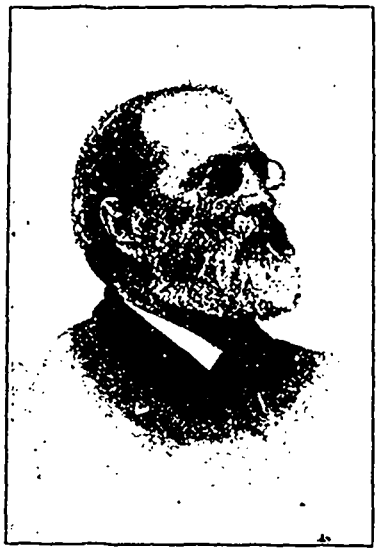
Have we not the same meaningless result when, in a statistical table, we add finished products, like fine copper or nickel, with such raw materials as iron ore, coal, petroleum or natural gas, and also with such other furnace or manufactured products as pig iron, matte, steel, coke, illuminating oil, brick, cement, carbide or calcium, &c.? Evidently yes! Such a table as the above gives us a total which cannot possibly mean anything as it represents neither the production of our mines, nor the production of our smelting or other metallurgical works, nor the production of other manufactured products largely made up of minerals. The tables may be entitled "mineral production of Canada," or of Ontario, or of some other province, for such and such year, but in reality they are nothing of the kind and are simply additions of figures. It is indeed quite certain that fine nickel or copper are not ores or minerals not any more than pig iron, matte, steel, coke, brick, cement, tile, sewar pipe, &c. When therefore we state, for instance, that in 1900 the mineral production of Canada was 64 and a half millions ($64,500,000) or that the mineral production of Ontario, in 1901, was $11,800,000.00. We really make statements that are far from being accurate, in their true sense. In reality the mineral production of Canada or of Ontario were less in the years above named. But, what is much worse than somewhat exaggerated values, is that it is impossible to tell, from the tables, how much these mineral productions really were; and thus, we are left entirely in the dark by the very statistics, collected and compiled with so much care and expense, to give us the very information which finally is missing. For indeed, if we try to get at the true mineral production, by deducting from the tables the values of the fine metals, mattes, pig iron, steel, brick, cement, lime and all other manufactured products and by replacing these with the values of the corresponding raw materials at the mines or quarries, we cannot find these last, except in the case of iron ore, and thus, as we said above, we cannot arrive at the real value of the mineral production which is the very aim of all our efforts. The value of our mineral statistics, as now published, is therefore greatly lessened by the want of clearness in grouping so many classes of products (from the mine, the smelter, the brick yard, the cement mill, &c.) all into the one table. This system we submit should be done away with and replaced by the following:—

1st. Separate statistics of the first marketable products of our mines and quarries—spot values.

2nd. Separate statistics of the products of our smelting and metallurgical works—spot values.

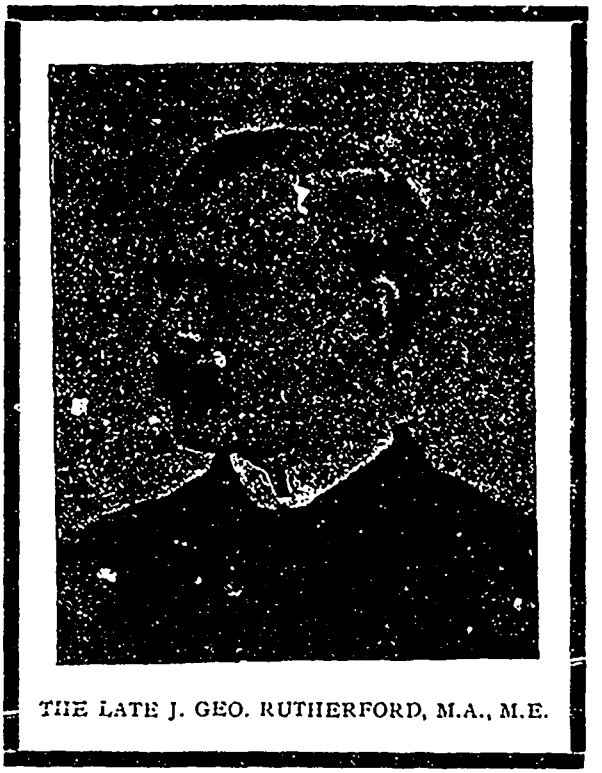
3rd. Separate statistics of the products of other mills or works using ores or minerals as raw materials, such as petroleum refineries, cement mills, brick yards, lime kilns, &c.—spot values.

This is the system which has been followed for a great many years by most of the European countries, and it certainly presents, as we pointed out above, over the one now followed by us in Canada and by the United States Geological Survey, the advantages of: first, perfect clearness. Secondly, this system will also climinate all fanciful values of fine metals, at New York or other markets. These market values might very well be considered and given as a matter of valuable information in a statistical report, but should never, in our opinion, form the basis of values in the tables as the spot values, at the mines or works, are certainly the vital points required to be brought out since they constitute the actual facts which alone can be recorded and which alone are really useful as representing existing conditions. Thirdly, it is a much more elastic system as under it the values of the raw products of the mines and quarries are first given, then the values of the more or less finished products of the smelting and other works are given in other tables, so that there need not be any more fear of repeti-



MR. S. M. ROBINS

Who was presented with an address by the citizens of Nanaimo, B.C., on retiring, after 20 years service, from the New Vancouver C.M. & L. Co.



THE LATE J. GEO. RUTHERFORD, M.A., M.E.

MR. PAUL JOHNSON

Who was banquetted this month on leaving the B.C. Copper Co.

The death of J. George Rutherford was a shock to his many friends. Only ten days before he had been with a number of colliery managers at Halifax who had noted with pleasure how much he enjoyed the reunion and who found it difficult to realize his health had been precarious.

He was the eldest son of John Rutherford, inspector of mines for Nova Scotia, 1866 to 1871 still a hale and hearty man, over 80 years of age. He was a brother of Colonel Rutherford of Ottawa. He was educated at King's College, Windsor, and studied mining in the North of England. After some experience at Sydney mines he became associated with his father at the Albion mines. In 1886 he became assistant manager to the Acadia Coal Co. and remained in their employ for 16 years. Just a year ago he left Stellarton to take charge of the Joggins Colliery, in Cumberland County, which he looked forward to modernizing and having it equipped for a greatly increased output. He leaves a widow and four young children of an age calling especially for a father's help. His very largely attended funeral at Stellarton showed how greatly he had been esteemed by the community there and the miners with whom he had dealings for so many years.

tion of values as in the present tables; and, the statistical analysis of the different industries; mining, metallurgical and allied industries can be pushed as far as desired, or convenient, or as far as it is possible to collect it.

Some Possibilities of Mining in Canada.

By FREDERICK HOBART, New York.

No ordinary man can, without risk, assume the part of a prophet. It requires a wider knowledge of conditions than most men possess, to enable one to foresee the changes which may in a few years affect the course of an industry, the discoveries which may turn the current of trade, or make methods and processes obsolete. It is possible, however, to take the conjunction of certain conditions, and to base upon them a reasonable forecast of coming events.

The growth of the mining industry of Canada has been uneven; in which the country is not at all peculiar. It seems inevitable that in all countries, mining, especially of the precious metals, should have its periods of boom and depression. Like the individual mine, the industry generally is now in bonanza and again in borrasca. It is not easy, indeed it has thus far been impossible, to devise any method of equalizing matters and distributing prosperity evenly over the years. The economists who have studied the problem, have generally given it up in despair.

At present matters are, to all appearances, improving. The complications which stock speculation imposed upon some of the best mines in British Columbia, for instance, are in a fair way to be straightened out, and an opportunity will be given to show their real value. The Eastern Ontario mines have found a way to work their complex ores, and utilize the by products.

While the resources of Canada in the precious metals, in nickel and lead, are important parts of her mineral industry, it seems to an impartial observer that only a beginning has been made on the two branches of mining and metallurgy, which present the greatest possibilities for the future, iron and copper. To take the last named first, some remarkable work has been done in smelting the low-grade ores of British Columbia, but this seems to be really only a beginning, an indication of what may be done in the future. The extent of the deposits of ore and the proximity of fuel and other materials point to a much larger production in the future. There can be no doubt that a period of greater prosperity is promised for the copper smelters. The attempt to maintain the metal at abnormally high prices, and, after that policy had broken down, the effort to force a general combination of producers by depressing prices, have both proved unsuccessful. The copper market is now, for the first time in three years, in a normal condition, where the old law of supply and demand has full affect. The result is seen in the steady rise of prices since the opening of the present year. There is no doubt that the present consumption of the world is fully up to production, notwithstanding recent increases. The mines and smelters which have been able to maintain their production on the basis of 11 cents, can certainly prosper when 13 or 14 cents can be realized. This condition seems likely to be maintained for some time to come; and it will not only keep existing mines at work, but will stimulate the opening of new ones, and prospecting for other deposits. Canada is already an important copper producer, and will, without doubt, improve its position in this respect during the next few years.

In this connection, it might be of advantage to establish an electrolytic copper refinery at some convenient point, so that the product of the western mines could be put on the market as fine copper, ready to be sold at home or abroad, instead of selling and shipping converter bars or standard copper, to be refined elsewhere. The output of the British Columbia mines will soon be large enough to warrant this—if it is not so already. It would seem that this suggestion is worth consideration.

The greatest opportunity for development in the near future, however, seems to lie in the direction of iron and steel production. These industries have, as we know, grown with unprecedented rapidity during the past two or three years. While this growth has been largely due to the energy and success of the Dominion Iron & Steel Company, it looks as if that Company were only a pioneer in the trade, and would undoubtedly have many followers.

Canada has great resources in this line. It is hardly necessary to call attention to the iron ores of Nova Scotia and the east. In the centre, the recent discoveries on the Hutton Range, which I understand are to be described by an expert at this meeting, show that the anticipation of important iron ore deposits in Western Ontario, within convenient reach of lake navigation, are to be fulfilled. The mines of Eastern Ontario have been described by Professor Miller and others. The ores of the coast districts of British Columbi. are still to be developed, but they exist in quantity; while other deposits in that Province were well described at the last meeting. The raw material is abundant, and on the eastern and western coasts alike, coal and coke are within reasonable distance. The modern tendency is to carry the ore to the fuel, rather than the fuel to the ore. Every reduction in the distance required for such carriage is a distinct economical gain.

In considering this question of raw materials, I may venture to suggest the hope that Canada, by legislation or otherwise, will be able to avoid the serious economic mistake which is now being made in the United States. The supply of raw materials is, as we all know, the life of any trade. The control of the iron ore supplies of the United States is quietly, but steadily, passing into the hands of the United States Steel Corporation, and practically no effort has been made to prevent it. The big corporation is seeking to control the trade, not by absorbing its rivals, so much as by putting them in a position where they will be dependent upon it for the material which they must have, if they are to exist at all. The enormons power which will thus be concentrated in the hands of one board of managers can only be appreciated in part now, since a similar condition has never before existed. To repeat, it is to be hoped that in Canada the mistake of allowing the control of a great industry to be held by one corporation will be avoided in time. The economic danger is great enough to over-balance any possible temporary advantage.

From the trade point of view, Canada is exceptionally well placed for a large development in the mining of iron ores, and the manufacture of iron and steel. The home demand is bound to increase steadily with the growth of population and business, and the belief in industrial independence. Beyond this, Canada's position will enable its manufacturers to take the fullest advantage of foreign markets. The eastern mills and furnaces have already begun to sell in British markets to advantage, as well as in those of the United States. They are well situated also to secure a share of West Indian and South American trade, and will doubtless do so before long. On the western coast the establishment of iron manufacture will enable Canada to compete—I believe with success—for the supply of iron and steel to Eastern Asia, and probably Australia also; while there is nothing to prevent the capture of the trade of the entire Pacific Coast. British Columbia has the most important supplies of iron ore and the only good coking coal on the coast; advantages which will surely be realized before long.

The Geological Survey and the Mining Bureaus of the different provinces have thus far rendered aid to the mining industry in various ways, though not all that has been demanded. The Ontario Bureau has given much attention to the iron ore deposits, and its example might well be followed elsewhere. The encouragement of iron mining

and manufacture by economic legislation is a matter outside of this paper, but will doubtless be well considered.

I have not attempted to go into details; the subject is too large for that. I have simply attempted to outline what seem to be the directions in which the Canadian mining industries will grow during the next few years. Iron and copper will, it seems probable, be the chief points of development; but this will not exclude progress in other directions, for which I look, and for which I hope.

The Modern Blast Furnace Laboratory and its Work.

By W. Dixon Craig, Midland, Ont.

The history of the last half century has been largely the history of industrial chemistry and in no branch of manufacture has chemistry played a more important role than in the manufacture of iron and steel. I should preface this paper by stating that it aims at being popular rather than technical in the hope of interesting a larger audience.

Following the logical order, we shall first then consider the work of the laboratory, and later, the laboratory itself,

The work of the blast furnace laboratory falls naturally into three sections: analysis of raw materials, analysis of product, and analysis conducted for furnace control; the analysis of both the raw material and the product are also, as will be seen below, absolutely necessary for control of the furnace

Although the knowledge of the chemical reactions which take place inside the furnace has not been reduced to the exact a science as the knowledge of some other processes, nevertheless it is quite allowable to say that we know enough of these reactions to afford definite guidance in the burdening a furnace. The problem of burdening a furnace may be stated thus—Given ore, coke and limestone—in what proportions shall they be put into the furnace in order, 1st, to make iron, and 2nd, to make iron suitable for a certain purpose? By purely empirical juggling with these various constituents good suitable iron has been made. But to get constant results, we must know the constituents of the raw materials. If iron ore were pure iron oxide, limestone pure carbonate of lime and coke pure carbon, one analysis would suffice forever. But iron ores are as varied as human nature and limestones are strikingly different, not only in different localities but in different beds of the same quarry, while cokes are also of many descriptions.

Before the furnace can be properly burdened then, it is necessary to have a full analysis of the ore, limestone and coke used.

The constituents generally determined in an iron ore are metallic iron, silica, phosphorus, manganese, alumina, lime, magnesia, sulphur and moisture. Special ores often require further special determinations. Each ore in use is analyzed once a week for the more variable constituents, and at certain intervals completely.

Similarly, the limestone is run every week for iron, silicia, alumina, lime, magnesia, and occasionally, for sulphur and phosphorus.

Coke is tested for sulphur every day, and at stated intervals analyzed for moisture, volatile, fixed carbon, ash, iron, silica, alumina, lime and magnesia.

I need scarcely point out that the samples of these various materials must be taken very carefully or the analysis will not represent the stock accurately and will consequently be worthless.

We see then, that before any material is allowed to enter the furnace, it is subjected to a chemical analysis. Of course, some ores are more desirable than others, generally because they are richer in iron. Other ores again, are useless on account of high percentages of sulphur. Still others are are most desirable for making bessemer iron on account of their low phosphorus content. It has thus come about that ores are bought and sold on chemical analysis. The furnace laboratory is, then, called upon to sample and test the ore received, to see if it comes up to specifications. Every cargo or carload of ore received is sampled and tested completely. The selection of a sample from a large cargo of ore thus becomes a very important matter. It may not be out of place here to state that the largest cargo of ore received at a Canadian port arrived in Midland, on Nov. 22nd, 1902, per the Agawa, of the Algoma Central Steamship Line.

In the same manner and for the same reasons, the limestone and coke received must be tested by the laboratory to make sure that they come up to the requirements.

The analysis of the product of the furnace—pig iron—is just as important as the analysis of the raw material. Iron is still very generally graded by fracture, but chemical analysis is coming to be regarded more and more every day as the most reliable test of the quality of pig iron.

The largest consumers of pig iron buy on chemical specifications. In making bessemer steel, an analysis of the pig iron used is absolutely necessary if a uniform steel is to be produced. However, it is not my intention to make *ex cathedra* statements as to the relative merits of grading by analysis and grading by fracture. The question is still a more or less controverted one. I would, however, point out the folly of regarding chemical and physical tests as opposed to each other. Chemistry and physics are mere arbitrary terms used by us to define our ignorance. No one science is separate and distinct. Our object is to know all that is to be known about a certain iron. The great advantage that the knowledge gained by chemical analysis has over the knowledge gained by inspection of the fracture is that the former is definite and unprejudiced while the latter is empirical and depends largely upon the grader's opinions and judgement.

When we come to consider the analysis of the iron as a factor in the control of the furnace, we see how important it is. Every cast is analyzed with the utmost speed in order that the man in charge of the furnace may know what kind of iron has been made, and thus what he must do to get the same iron next cast, or to improve the grade of the next cast. Every cast is analyzed for silicon and sulphur, and phosphorus and manganese are determined in a certain number of casts depending on what kind of iron is being made.

The result of the analysis is in the hands of the furnace superintendent long before the iron is cooled. Half an hour always suffices for analysis. Many casts are run in far less time than this. If the furnace superintendent had to depend upon the fracture of the iron for his knowledge, he would have to wait considerably longer and thus make his changes so much later.

Every pound of iron produced is thus analyzed for the purpose of affording guidance in the running of the furnace and supplying the market intelligently.

Already it is the custom with all large consumers of pig iron in the United States to buy strictly on chemical analysis. This practice is spreading and it is only a matter of time before most of our Canadian consumers will follow suit. The advantages of this are apparent at a glance. The foundryman or steel maker, knowing the character of his stock, can order iron of the must suitable analysis. He can test closely the iron he receives, thus making sure he is getting what he is paying for. On the other hand, the manufacturer of iron is relieved of all responsibility after supplying the desired iron, and runs no risk of having his iron blamed for bad results which are due to another brand.

While pig iron is the product proper of the blast furnace, it also produces two other materials—slag and gas.

A knowledge of the chemical nature of the slag is of great assistance to the furnace superintendent. While this can be estimated roughly by its appearance, it is usual to have a sample taken from every flush, and an average sample made up from these to represent the twenty-four hours—thus checking the work of the furnace. To illustrate the value of this—A certain burden is put on the surface, calculated from the latest analyses at hand; by calculation, the slag should have a silica content of 32 per cent. After twenty-four hours running, the slag is analyzed and found to run thirty six per cent. in in silica. It is needless to remark here that this will have a considerable effect on the iron produced. Knowing the analysis of the slag, it is a simple matter to calculate just how much more limestone should be added to the burden to bring the silica back to thirty-two per cent. In this way close watch may be kept on the furnace. The slag is analyzed every twenty-four hours for silica, alumina and lime. The gas is more rarely tested. A knowledge of its composition, however, often affords a valuable aid to the control of the furnace.

I now give some detailed notes on some of the methods of chemical analysis used in the Midland Laboratory.

PIG IRON.

Silicon.—Textor's Chromic Acid Modification of Drown's Method.

To one gram of drillings in a number 4 casserolle add 15 to 20 c.c. of water; then 25 c.c. Silicon. Mixture. (1 part Sulphuric Acid, 1.84 specific gravity, 2 parts Nitric Acid, specific gravity 1.20), heat over a small Bunsen flame till desolved or violent action ceases and evaporate rapidly over full Bunsen flame without use of gauze or asbestos board. When the solution has evaporated sufficiently, the iron sulphate becomes insoluble and is thrown up against the cover glass. Remove from the lamp and while hot add 15 c.c. of a water solution of chromic acid, (120 grams to a litre of water), boil again as before, until the chromic acid Crystallizes out. Remove from lamp, add hot water, slowly at first, boil a few minutes or till dissolved and clear; filter. Wash the chromic acid out of the filter with hot water, then wash with warm dilute hydrochloric and lastly three or four times with hot water. Ignite and weigh. *Precaution.* The evaporation with chromic acid must not be carried too far, otherwise insoluble salts are formed. On the other hand, if the heat is not continued long enough, the graphite will not all be oxidized. The small amount of graphite occasionally remaining is very quickly burned off in the ignition.

I have given the above method in detail as it is not very well known and is an extremely rapid method for pig iron. It is very accurate and simple. Determinations in our laboratory are run regularly in 20 to 30 minutes

Sulphur.—The evolution method is employed. The iron is treated with dilute hydrochloric acid. The sulphur is evolved as hydrogen sulphide, which is collected in an ammoniacal solution of cadmium chloride. The precipitate of cadmium sulphide is finally dissolved and the solution titrated with standard iodine solution, standardized by a standard iron. Some improvements on and modifications of this method are now being tested in the laboratory.

Phosphorus.—Emmerton's method is used as given by Blair. (1) The standard solution employed is standardized by a standard iron.

Manganese.—A modification of Volhard's method (2) is in use at present. A new method is being thoroughly tested, and if accurate, will be adopted. (3)

(1) "Chemical Analysis of Iron."—Blair.
(2) "Chemical Analysis of Iron."—Blair.
(3) "Journal Amer. Chem. Sec. XXIV, 1204 "

Graphite.—Method as given by Blair. (1.)

Combined Carbon.—Eggertz Color Method. (2.)

In four of the above methods a standard iron is necessary. The standardized drillings of the American Foundrymen's Association are used, and one cannot speak in too high praise of the enterprise and thoughtfulness of this association in preparing this laboratory necessity in such an admirable manner.

ORES.

Metallic Iron.—Solution in hydrochloric acid, reduction with stannous chloride and titration with potassium bichromate. (3).

Phosphorus.—The ore is brought into a nitric acid solution, the insoluble residue being fused, if necessary, and then determined as in pig iron, except when titanium is present—*vide infra.*

Manganese.—The ore is brought into nitric acid solution, the insoluble residue being fused, if necessary, and then determined as in pig iron.

Sulphur.—The *Aqua Regia* method is used. I would note here the importance of two points in this method—a double evaporation to dryness before the insoluble residue is filtered off, and secondly, after precipitation by barium chloride, the evaporation of the solution to very small bulk in order to drive off the acid and render the barium sulphate completely insoluble. These two points are often overlooked.

Silica.—The ordinary separation by evaporation is used. The ore is decomposed in hydrochloric acid, filtered, the residue fused and the fusion dissolved in the filtrate. This solution is evaporated to bone dryness, taken up in hot-water and hydrochloric acid, filtered, and the filtrate evaporated to dryness, dissolved and again filtered as recommendep by Hillebrand. (4) The two residues are ignited and weighed as Silica.

Alumina.—The alumina, lime and magnesia are in the filtrate from the silica. The alumina may be separated by the basic acetate or ammonia separation. The percipitate of ferric oxide and alumina is dissolved in dilute hydrochloric acid and the alumina precipitated from this solution as aluminum phosphate by Camp's Method. (5)

Lime and Magnesia.—Are determined by ordinary methods. (6)

Titanium.—This determination is generally required in ores in which phosphorus occurs. Gooch's method is used. (7) Many of the methods recommended for the determination of titanium and phosphorus are unreliable because they fail to make a complete separation.

Limestones.—The ordinary methods (8) are used. The same precaution is adopted in determining the silica as in ores. Lime is determined by titration with potassium permanganate.

Coke.—The ordinary methods are used. Sulphur is determined by the fusion method. Eschka's method has been used, but in our experience, cannot be fully relied upon.

Slag.—Ordinary methods are used, very similar to those used for limestone. I have given above a short *resume* of the analytical methods employed for iron work in the Midland Laboratory. It should be understood that new methods are being looked for always and tested as to their desirability. Details of these methods can, of course, be found in the references.

It way be of interest to note that a committee of the American

(1) "Chemical Analsis of Iron."—Blair.
(2) "Chemical Analysis of Iron."—Blair.
(3) "Chemical Analysis of Iron."—Blair.
(4) "Journal American Chemical Society. XXIV. 562."
(5) "Methods of Iron Analysis."—Phillips.
(6) "Chemical Analysis of Iron." Blair.
(7) "Chemical Analysis of Iron."—Blair.
(8) "Chemical Analysis of Iron."—Blair.

Foundrymen's Association is at present at work on the selection of standard methods for the analysis of pig iron and that this laboratory is participating in this work.

I should now like to say a few words on the relation between the Canadian Mining Institute and the work of the Blast Furnace Laboratory.

Granted that the iron industry of Canada has a future of importance, it behooves this Institute to keep in close touch with it, and hence with the laboratory and its work. I have referred above to the work of the American Foundrymen's Association. This body has prepared a set of four standardized drillings which have proven of inestimable value to iron chemists and the iron industry at large. They have also put forward a standard method of sampling pig iron which is now on trial. As stated above, a committee of the association is now at work on the selection of standard methods for the analysis of pig iron.

The American Chemical Society also, has published valuable standard methods for the analysis of coal and coke.

Now, while Canadian chemists profit by this work, I look forward to the time when these matters may be controlled by a Canadian Society.

While it would be too much to expect the Institute to take up this work at the present time, there is a need which it might meet.

A standard iron ore would be of great value in a furnace laboratory and in many other directions. Prepared by the Canadian Mining Institute, it would be a reliable standard for use all over Canada. At the same time, it would be a start in the right direction. The Canadian Government might reasonably be expected to assist in this, as the matter concerns it in the analysis of iron ores required in connection with the bounty on pig iron.

Another work which would be of value is the selection of a standard method of sampling ore cargoes and car shipments. This would result in the avoidance of disputes between buyer and seller.

One further suggestion I would throw out before leaving this subject—the formation of a chemical section of the Institute. While probably many Canadian chemists are, like myself, members of the American Chemical Society or the Society of Chemical Industry, I believe that a section devoted to mining and metallurgical chemistry would be welcomed by those chemists who are already members of the Institute, and might result in the acquisition of new members. This section might be allowed to hold a one day's or a half day's session at the meetings of the Institute in which technical papers could be read. I believe this would assist in making the Institute the premier Canadian Society.

I do not elaborate further on these points as I hope they will call forth valuable discussion, giving the Institute more weighty opinions than my own.

Having taken up the work of the laboratory, I now turn to the laboratory itself. As far as this subject goes, I cannot do better than give a description of the Canada Iron Furnace Company's Laboratory at Midland.

The Laboratory is situated on the hill, back of the furnace plant, over-looking Midland Bay. Being some distance from the furnace, it is as free from dust and vibration as possible. Every chemist will understand what a valuable consideration this is. The building faces south and is 30 x 40 feet and from 30 to 40 feet in height. It is constructed of sold brick, with granite foundations and trimmings. The most noticeable point from an exterior view is the large amount of window space. On the south aspect, or front of the building are two large windows, each subdivided, and a glass paneled entrance. The other three sides of the building are provided with two windows each. There are three entrances to the building In the front is a spacious porch and double doors leading into the hall or vestibule. On the north or rear wall is another half glass door, for the convenience of the laboratory staff. At the east side of the building is the basement entrance for the reception of fuel and laboratory supplies. The main entrance and all the windows are provided with awnings for the summer season.

The draughr stack appenrs in the centre of the roof, which is constructed of fire proof cement. The general design of the building is similar to that of the other permanent buildings on the plant.

The main entrance leads into the hall, from which doors open into the office and laboratory proper. A fire extinguisher is kept in the hall in case of emergency.

The door leading into the office is provided with a glass panel bearing the initials of the company—C. I. F. The laboratory door is private and is the only door on the main floor entirely constructed of wood. An oak wainscoting runs around the wall; this is continued in all the other rooms, the laboratory included.

The office, which is 13½ by 15 feet is intended for the use of the chief chemist, and for the housing of the mineral collection which is maintained in connection with the Exploration Department. In this collection are specimens of ores, chiefly those of iron, from all parts of Canada, more especially of Ontario. Specimens are being added to this constantly. The nucleus of a technical library is also kept here. It is the intention to gather about this an extensive collection of geological and chemical works. The windows of the room look on the south and west and command a complete view of the plant. A private telephone connects with the other departments. A glass paneled door opens from the office into the laboratory. The three front rooms, office, hall and balance room, are separated from the main part of the building by a ceiling and walls 16½ feet high. As the roof of the building constitutes the ceiling of the laboratory, there is a considerable amount of space above these rooms. The walls of the laboratory are 20 feet in height; above this the roof slopes from all sides to the apex, which is 30 feet from the floor. The roof is supported by two trusses and suitably finished with a wood ceiling. There are two ventilators placed in the roof for carrying off foul air and any stray fumes. The shape of the roof, admirably adapted for the collection of fumes, and its extreme height, are very important factors in keeping the laboratory atmosphere pure. The room is 14½ by 38½ feet.

In the center of the building, and consequently on the south side of the laboratory, the draught stack rises. The fume cupboard, or hood, is built around three sides of this. It is 9¼ feet long by 4½ feet wide. The total height is 13 feet and the walls are 9 feet high.

It is provided with a two inch blast pipe from the furnace blowing engines, running up the inside and into the opening into the draught stack. This provides a perfect forced draught. All operations in which noxious fumes are produced are conducted under this hood and the fumes instantly removed by the strong draft. The working surface of the hood is a heavy slate slab entirely unaffected by any acids which may be spilled on it. The hood is made of solid, polished oak and forms a very handsome piece of laboratory furniture. Below the slate slab is a large locker. The hood is fitted with twelve gas cocks and provided with a large hot plate 19½x22½ inches, and one large ideal gas burner providing a second smaller hot plate. Inside the hood are two small shelves for the reagents used in running the casts for silicon. The sashes of the hood may be raised or lowered at pleasure. At either end, just outside the window sashes, is an electric lamp.

The work tables run along the walls of the room, just below the windows. These are 30 inches wide and 3 feet high; there are 54 running feet of working space. There are two windows on the north

side and one at each end of the room. Thus, every table but one has a window immediately over it. There are five tables, one at each end, two on the north side and one on the south side, against the office. Over the latter is a set of shelves for glassware and chemicals. The table tops are of wood, painted black and waxed with paraffin for protection against acids. This description of tables has been found very satisfactory.

Along the inner side run three sets of pipes with cocks at intervals.

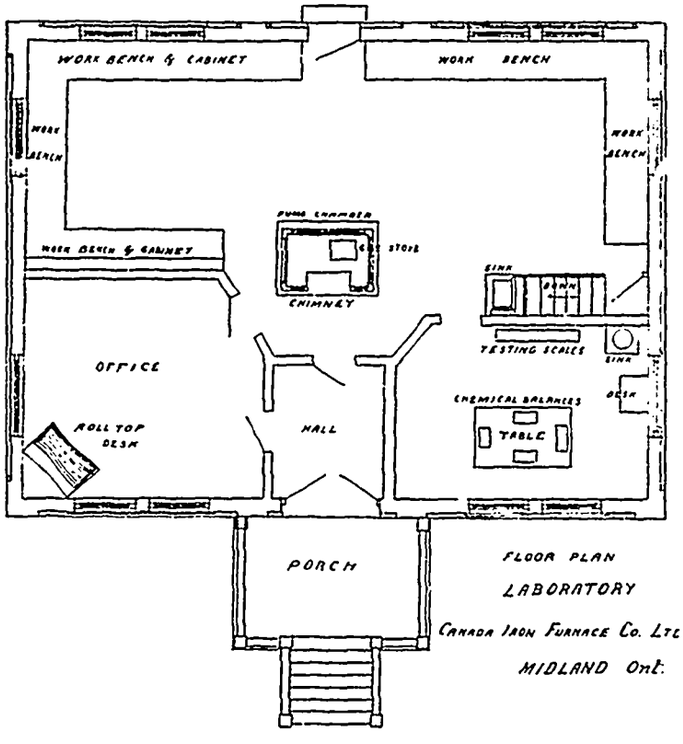
One of these pipes is for gas. The second comes from the blast pipe in the basement which leads from the blowing engines; this provides blast for the blast lamps. The third pipe comes from a very powerful filter pump in the basement, producing suction for rapid filtration. Thus, by simply opening a cock, gas, blast or suction can be obtained at different places on each table. These pipes are boxed in, forming a small shelf at the back of each table for apparatus and work under way. Above this shelf is a second one of plate glass, running along above each table, for reagent bottles. A plate glass shelf can always be kept clean, which is impossible in a wooden shelf on which reagent bottles are kept.

Above each table hang two electric lamps for night work. Under each window, below the table, is a large hot water radiator. The tables are provided fully with drawers and lockers of oak.

At the east end, on the south side of the room, is the door leading to the basement stairs, which are closed in by an oak closet. On the top of this closet is kept a carboy of distilled water. At one end of this closet is the sink and draining shelves for glassware.

The situation of this work room on the north side of the building obviates much trouble from direct sunlight, while its shape, long and narrow, and the large windows, ensures perfect light in all parts of the room. The loftiness of the ceiling keeps the atmosphere as clear as is possible in a busy laboratory.

South of the laboratory, at the east end of the building, is the balance room, which is entered by a swing door with glass panels. It



may seem superfluous to say that a swing door for the balance room is a wonderful convenience, but it is surprising to know that many laboratories lack this feature. The room is 15½ feet by 8¾ feet and has windows on the two sides of it. In the middle of the room is a concrete pier, separate from the floor and resting on its own foundation in the basement. This prevents any jarring of the balances. This pier is cased in paneled oak and on the top is a polished oak slab 3½ feet by 5¾ feet for the balances. There are two Becker and one English balance, and a pair of counter scales on this table. Each balance is provided with an electric lamp. The position of the table, in the center of the room, is to be recommended on account of the advantages of having the light come from behind while weighing. The windows are provided with sash curtains for keeping direct sunlight off the balances, while at the same time not shutting off the light entirely from the room.

On the north side of the room stands a Buffalo Testing Machine for making physical tests on the pig iron. The room is also provided with a wash stand, desk and hot water radiator.

The whole building is floored with maple, and finish throughout with oak.

Gas is obtained from a 50 light gas machine of the Detroit Heating and Lighting Co. This has given perfect satisfaction and is exactly the equivalent of city gas in point of convenience.

The basement is the full length and width of the building. In one corner is a store room for supplies and chemicals, in which the gas machine is kept. A Preston boiler for hot water heating is placed beside the base of the stack. In another corner of the room is the concrete pier for the balance table.

There are five sets of pipes in the basement—for hot water heating, gas, water, blast and suction. There are three windows and a door, referred to above. The floor is of concrete and cement.

I should explain that the equipment for handling samples is in the machine shop. A steam power sample crusher, grinding mortars, steam bath, mixing floor, etc., provide facilities for handling very large samples of over a ton, as well as smaller ones.

Altogether, it may be said that this laboratory is one of the finest in America, Its situation, design and finish would be hard to improve upon. It was designed by Mr. John J. Drummond, General Superintendent of the Company, built by Foreman Mr. George Beatty, now Superintendent of the Londonderry Iron & Mining Co., Londonderry, N. S., the writer being responsible for many of the details. I may best conclude this sketch by saying that the character of this laboratory is one of the hopeful features in regarding the feature of industrial chemistry in Canada.

Air Compression by Water Power: The Installation at the Belmont Gold Mine.

By D. G. KERR, C & M.E., Deloro, Ont.

This water power is situated in the township of Belmont, county of Peterborough, Ontario, about three miles in a north-west direction from the Belmont Gold Mine.

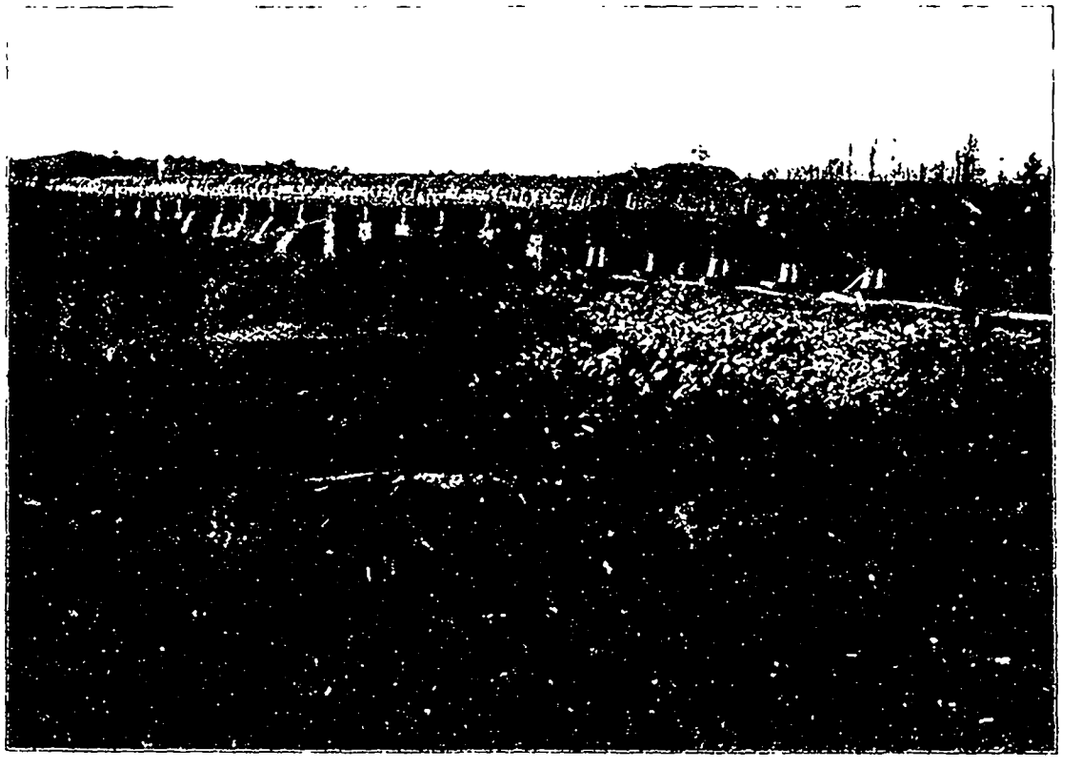
On the outlet of Deer Lake there are falls and rapids which give a head of 75 feet in a distance of 1600 feet. Still further down the river there ir another drop of 25 feet, all being on the property of The Belmont Gold Mine, Limited, Cordova, Ontario.

Deer Lake is about four miles long by a mile wide and holds a splendid reserve of water for the dry season. The lake is fed by a chain of smaller ones which extend north about 100 miles. This makes an ideal situation for a power plant.

After the power was acquired the question was electricity or compressed air. The generation and transmission of electricity would have cost less at the power house and to the Mine, but it would have been necessary to have put up a motor driven air compressor at the

AIR COMPRESSION BY WATER AT BELMONT MINE.

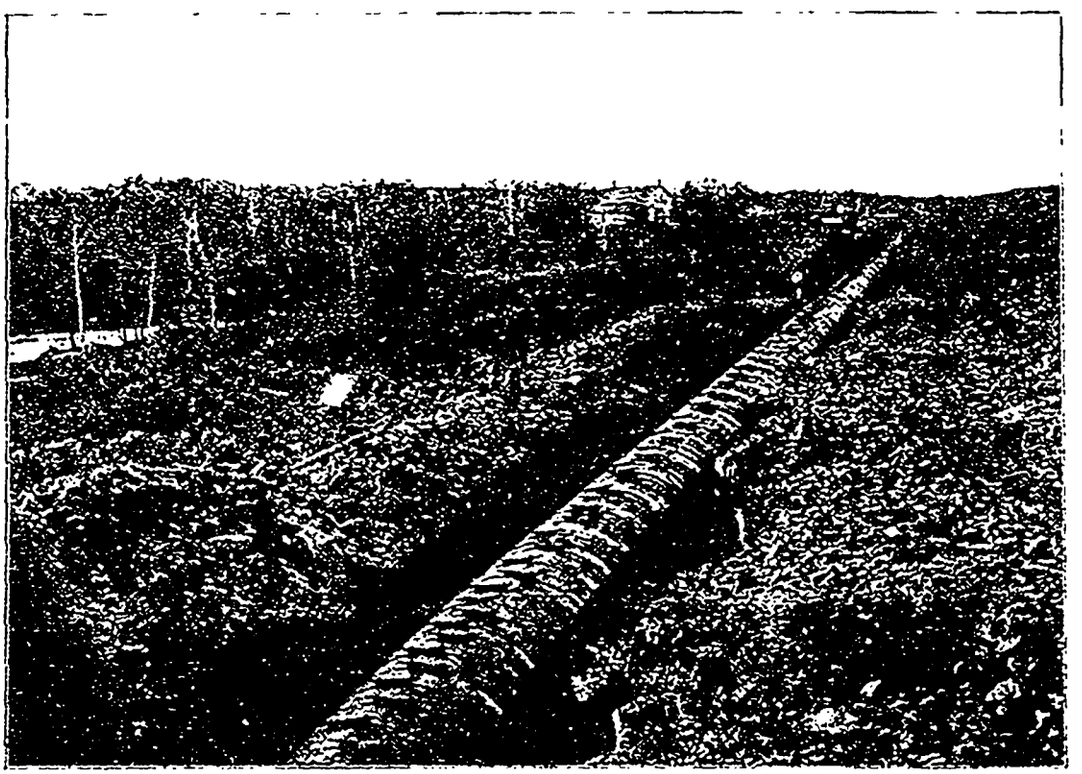
Lower part of Flume and Power House—Belmont Gold Mine.



Centre of Flume Pipe—Belmont Gold Mine.

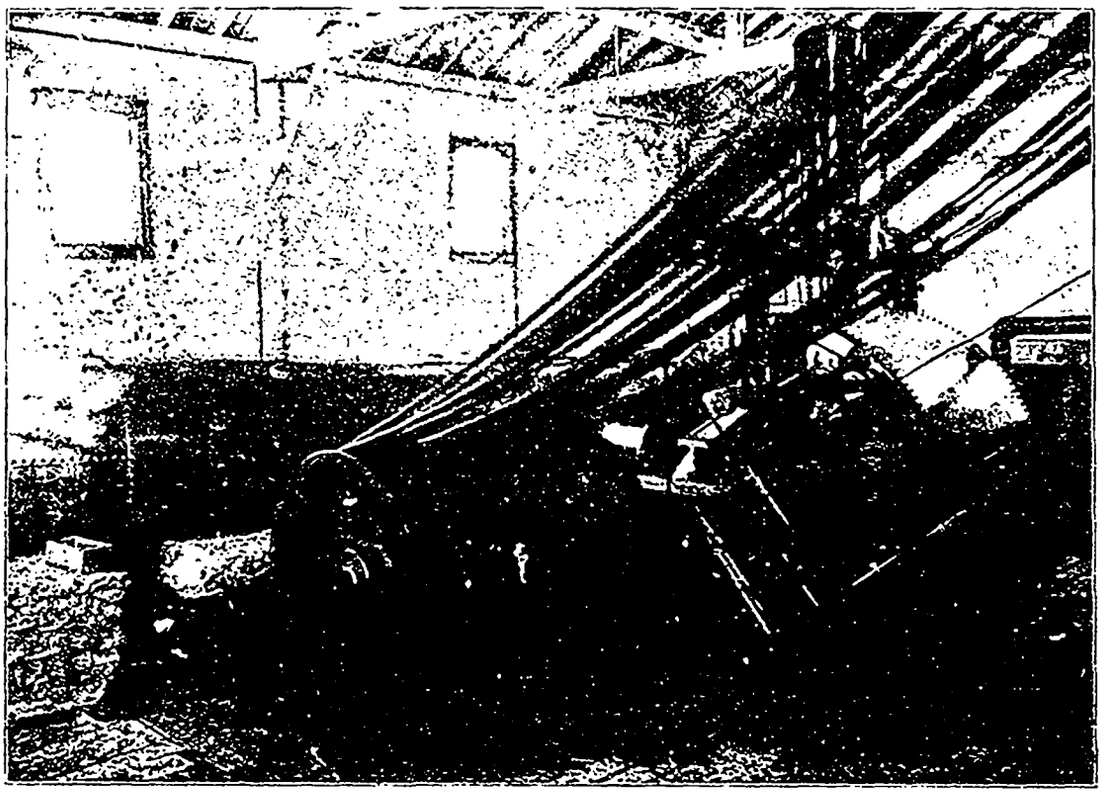
AIR COMPRESSION BY WATER AT BELMONT MINE.

Power House, showing Tail Race and Air Pipe leading to Belmont Gold Mine.

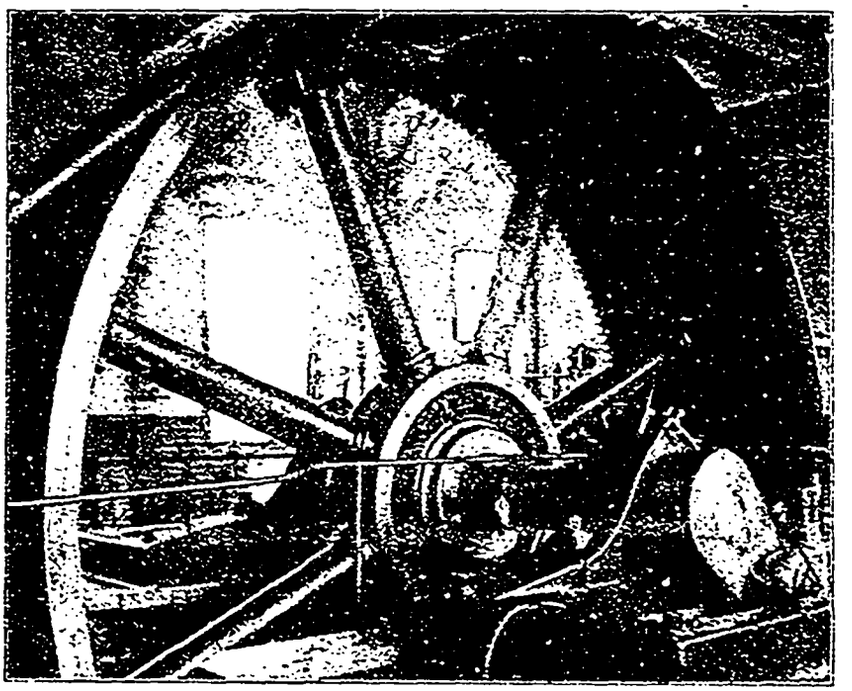


Flume Pipe. Upper part Dam in the distance.

AIR COMPRESSION BY WATER AT BELMONT MINE.



Water Wheel Section, Rope Pulley in motion—Belmont Gold Mine.



Rope Wheel on Compressor—Belmont Gold Mine.

Mine to supply drills with air, and motors at hoists and engines. This would have brought the first cost of the electric installation to a higher figure than one large air compressor plant, besides, the attendance, etc., at the motor driven compressor at the mine would swell the working costs. By installing one large air compressor at water-power and carrying the compressed air in pipes to the mine, branching it off in all directions to the shafts and mill, without having to make any alterations on any of the engines or hoists, all that was then required to be done was to shut off steam and turn on air to the engines, hoists and pumps without any loss of time when air was turned on at power plant. This left the steam plant; boilers, etc., with all their connections as a good reserve power in the event of anything going wrong with the air power. In this arrangement, it permits the using of machinery which was comparatively new, being only two or three years old.

One important point was the getting in of an air compressor plant large enough to do the mine work for a long time to come. As the underground requirements for air increased there could be more power developed at the falls by electricity to work the surface machinery. Then would be the time for considering the motor driven machinery as by that time the proper size of machinery for handling the quantity of ore would be better understood.

The outlet of Deer Lake was formerly by two channels, 300 feet apart, through a fine grained Diorite rock. The south channel was closed with a concrete and cement masonry dam, 85 feet long, 9 feet wide at top and 16 feet at base and 15 feet deep at the greatest part. On top of the dam are small piers 18 feet apart for bridging with timbers for a passage across. Underneath this and over the top of the dam the surplus water goes when stop logs are in at the slide way on the north dam. The north dam is 75 feet long with a 25 foot slide for the passage of logs. In front of the north side is a forebay with a 30 foot rack. This is where the water is taken out of the lake for the power, through a 7 foot square opening in the dam with a gate on the side next to the lake. The gate is worked by means of a rack and pinion wheels wrought by worm shaft and wheel. The water intake to the flume is reduced from 7 feet square to cylindrical by means of steel work with flanges and fasteners for the wooden staves of flume pipe. On top of the dam, behind the gate and going down into the water entrance of the flume pipe is a man or air hole. Without such, the shutting down of gate at the dam, allowing the water to pass through the wheel, would create a vacuum in the flume, causing a tendency to collapse or disturbance to staves, resulting in much trouble and annoyance through leaks when water was turned on again.

The flume pipe is 1,550 feet long, 6 feet internal diameter and made of 2½ inch. pine staves, 6¼ inches wide, radial edges, butt joints with saw drafts cut 2 inches into both ends into which was placed a steel plate ¼ of an inch wider than the stave to embed into the staves on both sides. No two joints come together, but at irregular intervals, the staves being cut in 12, 14, 16 and 18 foot lengths and clamped with 2000 3-16 x 2 inch steel bands and fastened with grip fasteners The pipe is carried on 12 inch square timbers circled out to take the outside circle of the flume, and these bearer timbers are placed 8 feet apart, centre to centre. The steel bands are spaced 3 inches apart at the lower end and 24 inches at the top. There are two curves in the flume of 20° each. The 6¼ inch staves were too wide and rigid to be sprung into place on the top of the flume, so ⅓ of the top staves going round the curves were made 3⅛ inches wide.

The bed for the flume was cut through ridges of rock for the first 900 feet from the dam, 3,960 cubic yards of rock excavation being done by steam drill in the winter season. At the lower end there is 217 cubic yards of stone piers to carry the flume over a low piece of ground before arriving at the power-house, and inside of the power-house a steel tube takes the place of wooden staves.

The cost of the wooden flume, made of pine, came out at $3.00 per foot, while the estimated price for this length of steel (flume only) was $15.00 per foot. The power-house building lies north and south and the part which contains the compressor is 40 x 50 feet. South of this is a cooler room 43 x 16 feet, and north of the main part is the water wheel part, 64 x 35 feet. The water-wheel is a double 50 inch bronze Leffel wheel with double discharge and running at 210 revolutions has a capacity of 800 horse-power, taking 7,500 cubic feet of water per minute. The water gates of the wheel are made of cast steel, and the casing of ¼ inch steel plates with cast iron heads. The water-wheel is carried on a steel shaft which extends at one end for the transmission of the power by means of a rope pulley, 5 inches in diameter and 6 feet 4 inches wide across the face, with 30 grooves for 30, 1¾ inch cotton ropes. On the top of wheel casing is a dome 2 feet in diameter by 10 feet high with valve, and just above this valve are two pipes, 12 inches in diameter, having spring valves and leading into draught tubes. This is an arrangement for the relief of undue pressures from water ram, such as might be caused by the water-wheel gates on a long flume through which water is travelling at a certain rate, being shut down quickly. This arrangement takes the place of a stand pipe; costs less and there is no danger of its freezing as it is all under cover. On wheel case is a guage showing water pressure and head in feet, and on draught tube is a vacuum gauge giving the vacuum in inches. The water-wheel, wheel casing, etc., were furnished by The Wm. Hamilton Mfg. Co., Peterboro.

Underneath the wheel is the tail sump, and from that the tail race going into the river. This was excavated out of solid rock to a depth of 20 feet and has cement masonry walls with steel beams and bolts with which the wheel casing is held in place. This tail sump is carried west underneath wheel to take the water from another wheel of 350 horse-power for which there is provision for water made on the steel part of flume by means of a tee piece. When this other wheel is at work the water velocity through the 6 foot flume will be brought up to about 10 feet per second. The intention is to development this 350 horse-power with a direct driven dynamo, alternating current.

The air compressor which is driven by these 30, 1¾ inch cotton ropes from pulley on water wheel shaft is one of Walker Brothers', (Wigan, England), Patent Air compressors; compound horizontal principle; high pressure cylinder, 30 inches diameter; low pressure cylinders, 48 inches diameter and with a 4 foot stroke. The cylinders are water jacketed, provided with improved accessable inlet valves and fitted with mattalic packing on the piston rods. It is rope driven by means of a 20 foot pulley, 6 feet 4 inches across the face, weighing 60,500 lbs. and built in sections on massive concrete and cement foundations, 14 inches high. Running at 65 revolutions, or a piston speed of 520 feet per minute, it will have a capacity of 6,500 cubic feet of free air per minute.

The low pressure air cylinder intake is connected together by branch pipe from the 3 foot pipe to the atmosphere outside. This 3 foot pipe lies horizontal on the top of the low pressure air cylinder, one end going to the south and the other to the west end of the building. The air is compressed in the low pressure cylinder to 30 lbs. pressure and is then discharged through a 14 inch pipe to the intercooler, and from there after being cooled, to the high pressure cylinder from which after being compressed to a pressure of 100 lbs. per square inch, it passes into the after-cooler. The inter-cooler and after cooler are filled with brass tubes through which flows cold water and the compressed air passes and repasses over the outside of the tubes and is cooled down to within 10° of the temperature of the water used. In this cooling process there is considerable moisture deposited, as it is only by cooling the air to the lowest, temperature that a high extraction of the moisture can be had.

The air leaves the after-cooler through a 12 inch pipe or ordinary oil well casing, having fine screwed couplings and tested to 600 lbs.

pressure. Half a mile out from the compressor is an air receiver to collect any moisture which may have passed the after-cooler. This moisture is drawn off every day.

The 12 inch pipe line from the compressor to the Mine is 15,000 feet long. At the end of this pipe line at the Mine is another air receiver to collect any moisture which may have been carried into the pipe line. The only time of the year that any moisture is expected to be carried this length, is when spring sets in and the heat of the sun frees any moisture from the inside of the pipe. This will be very little as the air receiver near the compressor is in a low swamp, and the air line leaving it for the Mine has a gradual raise of 50 feet in the 2,000 feet, thus draining moisture back into the receiver. The pipe line has 18 expansion joints and is mostly all buried in sand to prevent expansion and contraction.

The foregoing is only a slight description of the plant. As it was only started running in August 1902, and has not been run up to its full capacity yet, the loss in pressure due to friction in transmission cannot very well be arrived at. The loss at present is less than 1 lb., but using the full quantity of air the loss is expected to be 3½ lbs. What I would like to have completed, but found impossible in the short time that the plant has been running, is a complete comparison between summer and winter of the temperature at which the air is taken into the compressor, the amount of moisture extracted and the temperature of water used in coolers.

During the past winter there was only one shut down owing to freezing. This was caused by the moisture in the receiver half a mile out from the compressor being allowed to freeze through not being drained off every day. The ice formed in a honey-comb form until it interfered with the air pressure at the Mine, reducing same to 65 lbs. while there was 105 lbs. at the compressor. Shut down and found the receiver full of this honey-comb ice. After taking out same, started up again and covered up the receiver with a shed, banked so as to keep off the intense frosts and permitting the moisture to be drained off.

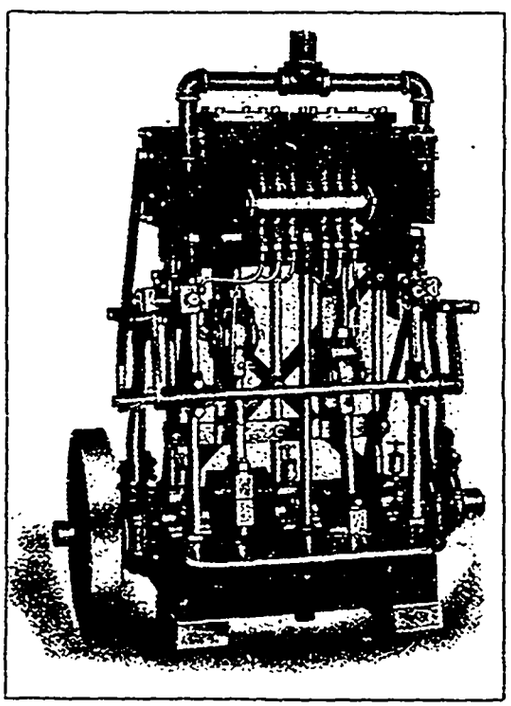
At the Mine I have had no trouble with freezing up except with a Corliss engine and a 14 inch Duplex pump. I find that engines with slide valves give no trouble, due to non-expansion of air inside of cylinder.

The Stewart River Gold Dredge.

By A. W. Robinson, Montreal.

This dredge was built in 1902 from the writer's designs for Mr. William Ogilvie, Ex-Governor of the Yukon for this development of claims on the Stewart River Yukon. The hull was built and machinery erected by Mr. W. M. Ogilvie, and the machinery was supplied complete by the writer under contract for a lump sum. This dredge is a special design for exploration purposes being very light and strong and capable of working to a depth of 25 feet. It nevertheless has sufficient capacity to enable it to do effective work and to handle free material at the rate of 75 cubic yards per hour. In this way if there is any reasonable amount of gold in the ground to be prospected it can be made to pay although, of course, its earning powers will not be so great as a dredge of larger capacity. For the development of our northern rivers the writer believes it to be good policy not to make a very heavy investment at the outset in a large expensive dredge until the paying qualities of the ground have been thoroughly demonstrated. There is undoubtedly a need for a light and strong dredge of this type which will be primarily a prospecting dredge, which can be built and placed on the property for a comparatively small amount of money, and yet has the strength and capacity to enable it to make money if money exists.

The writer believes that the class of machinery that has heretofore been built for work of this kind has been entirely too heavy and cumbersome to send to such remote regions where the cost of freight is so high and the loss from breakdowns is great. This is due to the fact largely that the dredges have been built by manufacturers who naturally put into the machine the class of materials and workmanship which suited them best, and which may not have been in all cases to the interest of the purchaser and user. The Stewart River Dredge is designed and built entirely in the interest of the purchaser and user and it is as light and strong as it can possibly be made. To this end all important parts subject to strain, are made of the best quality of steel forgings or castings and as little cast iron used as possible, in fact, almost the only cast iron parts used in the outfit are the engine cylinders and the grate bars. These are of cast iron because no other material will answer the purpose so well. The arrangement of the



Main Engines 8" x 8".

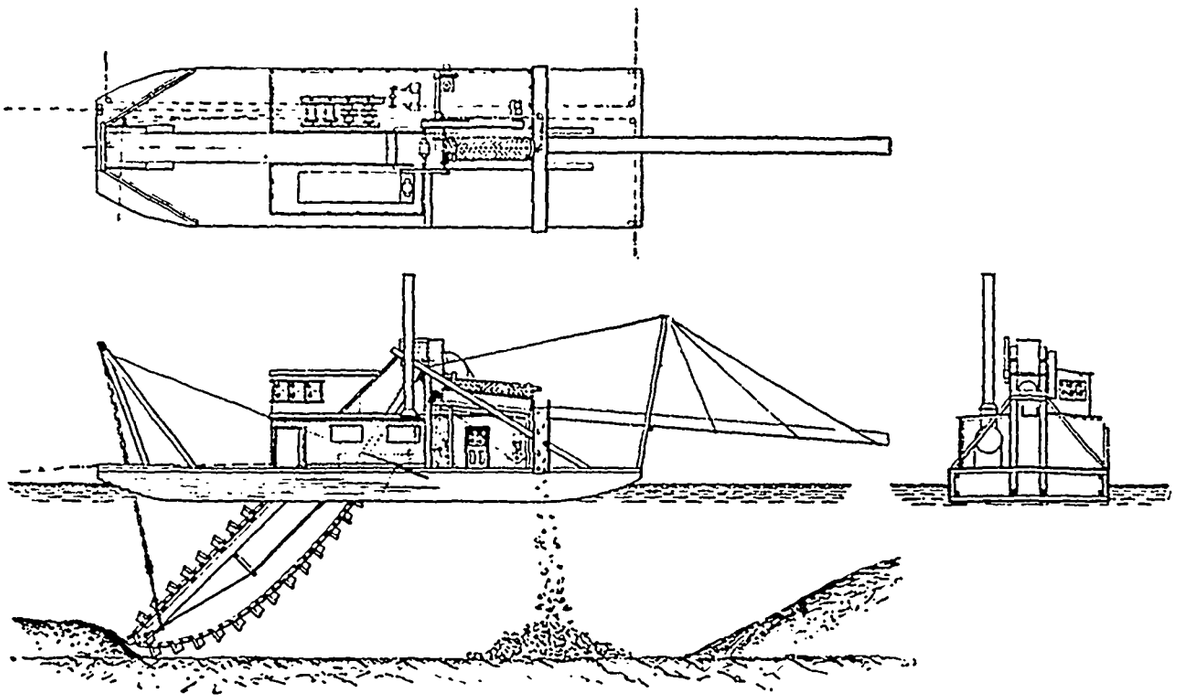
parts is such that the various movements are accomplished with directness and simplicity, and so that all the operations are under the control of one man. For facility in shipment the parts are sub-divided into convenient size and weights.

In carrying out the idea above outlined many radical departures from the usual construction were made, and a form of construction of the principal machinery was adopted after much consideration and study, which gives the greatest simplicity and the smallest number of parts that can possibly be used to accomplish the desired result.

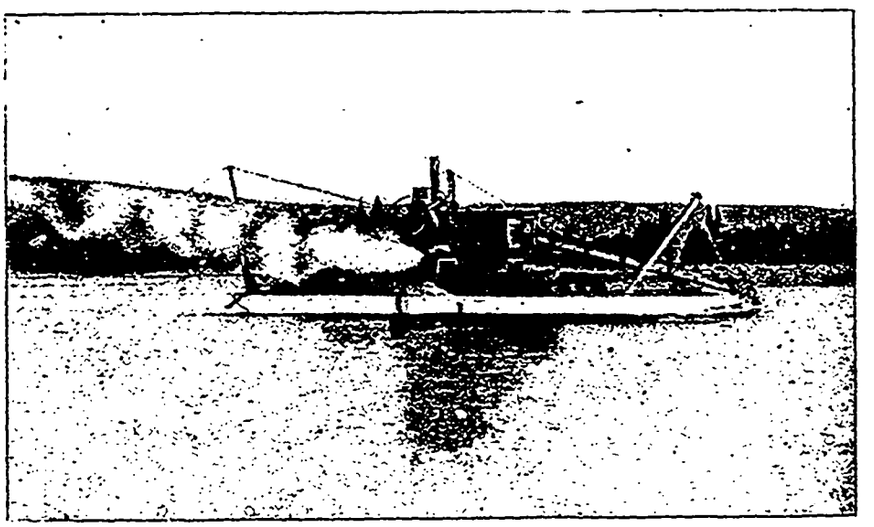
The importance of simplicity and strength in a machine of this kind can only be appreciated by those who have had to struggle in a far off locality with a machine which was so complicated that it was difficult to keep it in order, and with certain parts so weak that they would break down. In a machine of this kind the presence of a single defective element is enough to nullify the advantage of all the rest which may be good.

The following is a brief description of the dredge:

The hull is of wood 85 feet long, 25 feet wide and 4 feet 6 inches deep, and is built of a form specially adapted to work in a rapid running river if required. The main framing is also of wood and consists of three main timbers on each side. These are connected in such a way as to hold the entire head machinery. The head frame timbers



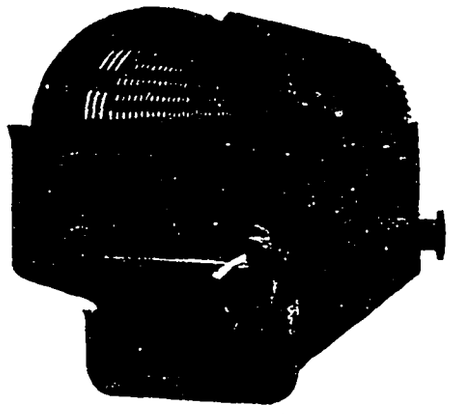
Stewart River Gold Dredge—Side Elevation, Plan and Cross Section.



General View of Dredge, in operation on Stewart River, Yukon

are connected by bracket castings of steel which also carry the ladder shaft so that no additional attachment is necessary for this purpose.

The dredge is fitted with a chain of buckets having a nominal capacity os 2¼ cubic feet each. These buckets are entirely of forged steel, no steel castings are used in their construction. Cast steel bucket back are extensively used for elevator dredges, and the writer has also used them successfully for gold dredges, but where it is necessary to keep the weight down to the smallest possible limit a higher degree of strength can be secured and the liability to breakage through flaws in the steel casting obviated by making it of forged steel. The lip plates of the buckets are of the highest quality of machinery steel of such hardness that they will resist abrasion and at the same time will have



Screen and Casing.

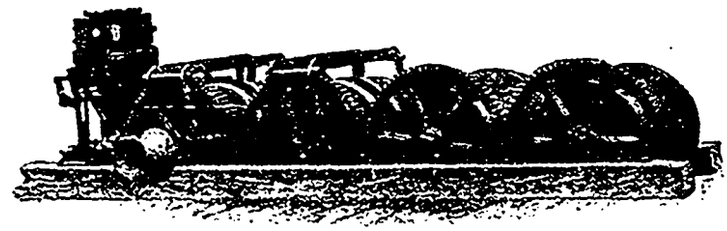
the requisite toughness to resist breakage. The pins are of Hadfield's Patent Manganese Steel, and all the pin connections are bushed with renewable bushings of oil tempered tool steel.

The material from the buckets is delivered into the hopper and passed through a revolving screen. The course tailings. are rejected and the fine material passes through the screen into the sluice box and is discharged astern. This dredge, therefore, is of the course screen and sluice box type, as distinguished from the New Zealand type, which possesses a fine screen and in which the gold is saved on tables. The writer perfers this type of dredge wherever it can be used on the score of simplicity and also because large capacity can be reached with a comparatively small screen, and the tailings oan be discharged astern and distributed without the necessity of employing a tailings elevator. The only objection that can be urged against the sluice box type is that it is not capable of saving the very finest gold, or at least, will not save as large a percentage of it as the fine screen and table method. This is, therefore, a question of adaptability to the character of the ground and the gold to be saved, and in the particular locality where this dredge is to be used the gold is sufficiently coarse to be saved, in the sluice box. The action of the gold-saving part of the dredge is, therefore, precisely the same as in hydraulic mining, and as the tailings are discharged astern with a large quantity of water, they can be so distributed as not to interfere with the work of the dredge. In special cases where the ground to be worked stands at a considerable elevation above the water, it may be necessary to employ a tailings elevator, but the writer has used dredges of this type which excavated their way through dry ground standing 10 to 12 feet above water, and disposed of all the material without any tailings elevator. The movements of the dredge are controlled by wire ropes attached to anchorages, or on shore, and operated by an independent steam winch. This winch is placed on the main deck and consists of six drums driven by a pair of independent engines. In the design and construction of this winch the ideal of keeping the weight down to the smallest possible amount has been fully lived up to, and at the same time the strength and efficiency has not been sacrificed but rather improved. There is no cast iron in this winch except the engine cylinders. The drums are of rolled steel plate with cast steel heads. The friction housings attached to each drum are of flanged steel plate with turned flanges. All the gears are of best cast steel and even the bearings in which the shafts are carried are steel castings of special and light design lined with babbit metal. The frame of the winch consists of two bars of flat steel to which all the bearings are bolted and which thus connects them all together and preserves the alignment and position of the gears. This bar frame is adapted to be down on top of timbers on the deck. Each drum is fitted with independent clutch and brake. The clutch operating levers are mounted on the winch and project up through the floor of the operating room above so that they can be directly reached and worked by the operator without any shafts, bearings, links or connections being necessary or attached to the boat in any way. This in turn greatly simplifies the erection of the dredge. It is only necessary to set the winch on deck and bolt it down, when it is ready for work as soon as the steam pipes are connected.

It may be incidentally mentioned that the time occupied in the construction and erection of this dredge was very brief considering the difficulties involved, and it is because of the simplicity of the design in little features such as these that the time of erection and completion was much less than ordinarily required.

The engines for driving the winch are of the vertical torpedo-boat type with a cast steel bed plate and forged and turned steel column frames. The engines are fitted with link motion and are of the highest quality of design and workmanship. They are so small and light that they can readily be picked up and carried by one or two men, and yet they are sufficiently strong that they can haul the entire dredge up a current of 9 or 10 miles per hour and can perform all the movements of the winch with ease.

With high class machinery of this kind built entirely of steel and of light weight, not only is the cost of transportation reduced, but the liability to breakage during handling and erection also. If these parts, such as the drums and flanges of the winch, had been made of cast iron as is ordinarily the case they might easily be broken through handling or falling on the ground or otherwise injured during the vicissitudes of their long journey. With these light steel parts, how-



6-drum Winch.

ever, no such risk is involved, and if by chance some parts should be injured or sprung out of shape through accident or a heavy blow it can be readily re-shaped and put back again.

The revolving screen is 38 inches in diameter by about 14 feet long. It is driven by steel gearing over the intermediate shaft of the head frame. A special method of driving this screen is employed which involves the use of very few parts and takes the power directly from the intermediate shaft. All the working parts are of steel and the screen is carried on four steel rollers. A special feature of this screen is that the perforated plates are built up on a steel frame in such a way that they can be readily replaced or renewed without taking down the frame or interfering with the driving mechanism. The holes in the screen are of large size being ordinarily calculated to permit about 80 per cent. of the material to pass through into the sluice box, only the larger stones being rejected. This practice is essentially different

from the New Zealand type in which the holes in the screen are comparatively small so that only the fine material passes over the tables. In the present case the screen with large holes allows the material to disappear quickly and, therefore, increases the capacity of the screen, and it also makes possible the disposition of the tailings without the use of the tailings' elevator, for the reason that only a small percentage of the material goes over the side, and which is not sufficient to obstruct the floating of the hull and the remainder is washed astern and distributed over a wide area by the combined action of the water and the movement of the boat.

The hopper into which the material is discharged by the buckets is also of steel and fitted with renewable lining plates.

The bucket ladder is of wood with steel fittingt and truss rods.

The main engines are of the double high pressure torpedo-boat type having cylinders 8 x 8 inches. The entire engines are of steel except the cylinders, which are of cast iron. The power is transmitted to the tumbler by means of a belt 14 inches wide and provided with a tightener pulley.

The reverse levers and throttle valve of these engines are controlled from the pilot house so that the whole of the operation of the dredge is under control of one man.

Steam is furnished by one semi-portable return tubular boiler. It has a cylindrical shell 54 inches diameter by 14 feet long, and it has a very large fire box arranged under its entire length and adapted to burn inferior wood.

The water for sluicing purposes is supplied by one independent centrifugal pump having 10 inch suction and 8 inch discharge. In many of the New Zealand dredges the pump is driven from the main

Buckets 2¼ cu. ft. capacity.

engines. The writer perfers to have it independent so that the water is under better control.

The hull is designed with ample space at after end so that gold-saving tables can be added at any future time if desired. The disposition of weight of the machinery upon the hull is such that it floats evenly and the draft of water does not exceed 3 feet.

The work of carrying out this enterprise as well as the erection and installation of the dredge on Stewart River was in charge of Mr. W. M. Ogilvie, and great credit is due to him for its accomplishment in so short a space of time in the face of many and great difficulties. The dredge was completed and put in service on the Stewart River just before the close of last season and could have worked a month if sufficient fuel could have been obtained. The parties, however, who contracted to furnish the fuel failed to fulfill their obligations, and as a consequence some time was lost. Sufficient was done, however, to demonstrate to Mr. Ogilvie's satisfaction that the dredge was a success and also that it was well adapted to work the ground under the conditions as they there exist. So many mistakes have been made and so many enterprises of this kind have ended in failure that the public is not yet prepared to believe that this dredge will prove an exception to the rule, but we have here a machine that is carefully designed and well-built, and that can perform its functions without continually breaking down, and I am sure that all the members of this Institute will unite in wishing Mr. Ogilvie the success he deserves when operations are renewed in the coming spring.

MINING INSTIUTUTE

Holds Largely Attended and Eminently Successful Meeting at Montreal—Many Valuable Papers Presented.

The Annual General Meetings of the members of the Canadian Mining Institute were held as usual in the Club Room, Windsor Hotel, Montreal, on Wednesday, Thursday and Friday, 4th, 5th and 6th March. The following among others signed the register of attendance :—

Thos. Cantley, Nova Scotia Steel and Coal Co., New Glasgow, N.S.
Robert E. Chambers, N. S. Steel and Coal Co., Wabana, Newfoundland.
B. A. C. Craig, Canada Corundum Co., Craigmount, Ont.
Major R. G. Leckie, International Nickel Co , Sudbury, Ont.
Captain J. Edwards Leckie, D.S.O., Torbrook Iron Mines, Torbrook, N.S.
Joseph Erriugton, Massey Station Mining Co., Massey, Ont.
Thomas W. Gibson, Director Bureau of Mines, Toronto.
George E. Drummond, Canada Iron Furnace Co., Montreal.
George R. Smith, M.L.A., Bell's Asbestos Co., Thetford Mines, Que.
Harry J. Williams, N.E.—Canadian Asbestos Co., Thetford Mines, Que.
James R. Pearson, Asbestos and Asbestic Co., Danville, Que.
Charles Fergie, Intercolonial Coal Co., Westville, N.S.
A W. Robinson, C.E., Montreal.
W. G. Miller, Provincial Mineralogist, Toronto, Ont.
Dr. Robert Bell, Geological Survey, Ottawa.
E. D. Ingall, A.R.S.M , Chief Division of Mines, Geol. Survey, Ottawa.
A. P Low, Geological Survey, Ottawa.
Russell Blackburn, Blackburn Mica Mine, Ottawa.
Prof. C. K. Leith, U.S. Geol. Survey, Madison, Wis.
John E. Hardman, S.B., M.E., Montreal.
Eugene Coste, E.M., Prov. Nat. Gas and Fuel Co., Toronto.
Thomas J. Drummond, Londonderry Iron Co., Montreal.
Prof. J. Bonsall Porter, McGill Nniversity, Montreal.
C. P. Hill, New York.
Fred. W. Hobart, Engineering and Mining Journal, New York.
J E Sancier, Matane Copper Co., Matane, Que.
J. Obalski, E.M., Inspecter of Mines, Quebec.
Jules Cote, Sec. Dept Lands, Fisheries and Mines, Quebec.
Dr. Frank D. Adams, McGill University, Montreal.
Dr. W. L. Goodwin, Director School of Mining, Kingston.
Dr. Eugene Haanel, Superintendent of Mines, Ottawa.
Dr T. L Walker, Toronto University, Toronto.
G. R. Mickle, M.E., School of Practical Science, Toronto.
Harry Wilson, C. & M. E., Montreal.
C. V. Corless, M.E., McGill University, Montreal.
S. J. Simpson, James Cooper Manfg. Co., Montreal.
E. W. Gilman, Canadian Rand Drill Co., Sherbrooke.
J. M. Jenckes, Jenckes Machine Co., Sherbrooke.
R. Auzias Turrene, Dawson, Y.T.
Fritz Cirkel, M E., Montreal.
Alliene Case, E.M., British and Canadian Lead Co., Temiscamingue, Que.
Dr. A. R. Ledoux, New York.
J. C. Gwillim, Queen's University, Kingston.
Prof. S. F. Kirkpatrick, School of Mining, Kingston.
R. W. Brock, School of Mining, Kingston.
R. P. Williams, Greenwood, B.C.
H. W. Lawrence and J. S. Mitchell, Sherbrooke, Que.
J. W. Evans, C.E., Deseronto, Ont.
W. W. Leech, Geological Survey, Ottawa.
J. A. Dresser, M.A., Richmond, Que.
D. Forbes Angus, Intercolonial Coal Co., Montreal.

Dr. Alfred W. G. Wilson, McGill University, Montreal.
W. S. Dresser, Sherbrooke.
Joseph James, Actinolite, Ont.
O. N. Scott, Listowel, Ont.
Wentworth F. Wood, Kamloops, B.C.
H. C. Farnum, Detroit.
W. W. DeCourtenay and A. W. Stevenson, Montreal.
M. F. Connor, B. Sc., Ottawa.
Francis T. Peacock and Robert Musgrave, Montreal.
J. McLeish, Geological Survey, Ottawa.
J. M. Clark, K.C., Toronto, Ont.
A. S. Fraleck, Mining Engineer, Belleville, Ont.
H. W. Weller, Babcox & Wilcox Boiler Co., Montreal.
W. H. McDougall, White River, Ont.
B. T. A. Bell, Editor Canadian Mining Review.

WEDNESDAY MORNING SESSION.

The members assembled at 11 a.m.

Mr. Charles Fergie, M.E., the President in the Chair.

The Minutes of the last Annual Meeting and the Report of Council for the year having been printed and distributed among the members were taken and read.

TREASURER'S REPORT.

Mr. J. STEVENSON BROWN presented his financial statement for the year showing: Receipts $7,338.29; Disbursements $5,655.80; Balance in hand $1,682.49. The disbursements showed expenditures on account of publications $2,756.37; Library $655.01; Meetings $655.90; Legislation and Deputations $165.40; Secretary's office $919.25; Treasurer's office $493.86.

The report was adopted.

NEW MEMBERS.

The following new members were elected:
W. H. Johns, Elizabeth Mine, Port Arthur.
J. Errington, Massey Station Mining Co., Massey, Ont.
W. E. H. Carter, M.E., Bureau of Mines, Toronto.
Wentworth F. Wood, Kamloops, B.C.
O. N. Frechette, Montreal.
Hugh Macpherson, Ontario Powder Works, Kingston.
Daniel O'Connor, Mine Owner, Sudbury.
Alliene Case, M.E., British and Can. Lead Co., Ville Marie, Que.
Frank Cochrane, Sudbury, Ont.
Charles M. Donohoe, Boston—Richardson Mining Co., Goldboro, N.S.
Col. J. Boardman Cann, Mabou Coal Mining Co., Mabou, N.S.
E. L. Fraleck, Mining Engineer, Belleville, Ont.

SCRUTINEERS APPOINTED.

On motion, Messrs. R. E. Chambers, Frederick Hobart and H. W. DeCourtenay were elected Scrutineers.

AUDITORS RE-ELECTED.

On motion, Messrs. H. W. DeCourtenay and George Macdougall were re-elected Auditors.

The meeting adjourned at twelve o'clock.

WEDNESDAY AFTERNOON.

The members met at three o'clock, the President in the Chair.

PRESIDENTS' ADDRESS.

Mr. CHARLES FERGIE who, in rising, was greeted with applause, said:—

It is most satisfactory to find our Council report the Institute in such a flourishing condition both financially and as regards membership, the members for 1902 being 453, shewing a gain of 70 over that of the previous year. The steady increase in membership, embracing as it does the best mining men of Canada and the United States, I think is the best criterion of the Institutes's worth as a Society for the discussion of the science and practice of Mining and other kindred subjects The papers published during the past year were of a high order, and will, I think, rank with those of other societies of its years and membership; no less than one hundred papers were presented during the year. The affiliation of the students of McGill and Queen's with this Institute I consider of great importance. By being associated with us they have all the benefits of the Society in the way of receiving the publications, attending meetings, and listening to and taking part in the discussions, and thereby profiting by the experience of the older members; they also have opportunity to write papers for the students' competition, and thereby educate and prepare themselves for work of importance they may expect to be called to do in the near future. I would strongly impress upon these students the great necessity and benefit to be derived from writing and expressing their thoughts in the form of a paper; it teaches them to think carefully for themselves, to express themselves clearly and concisely, gives confidence in themselves, and as I said before, is preparing them for the important work they expect to take up later as a profession. That this organization is of great benefit to the mining fraternity I think will not be denied, both as a medium for protection against pernicious legislation and for the interchange of knowledge and ideas in the ordinary everyday practice of the mining and metallurgical engineer.

PROSPERITY OF COAL MINING IN CANADA.

The year 1902 has been one of unbounded prosperity for Canada, and it is most gratifying to believe that the present one will be equally so. The production of coal in the Dominion during 1902, was approximately:—

Nova Scotia—		
Cape Breton	3,470,449	
Inverness	120,587	
Victoria	12,037	
Total Cape Breton Island	3,603,073	
Pictou County	567,237	
Cumberland County	555,170	
Total for Mainland Collieries	1,122,407	
Total for Nova Scotia		4,725,480 tons
New Brunswick		10,000 "
Assiniboia		69,000 "
Alberta		346,654 "
British Columbia		1,750,000 "
Yukon		2,000 "
Total		6,903,134 "

COAL TRADE.

Bituminous mined in Canada		6,903,134 "
Bituminous imported (round and slack)		3,806,129 "
Total Bituminous		10,709,263 "
Less exported—		
Great Britain	19,986 tons	
United States	1,854,753 "	
Newfoundland	123,738 "	
Other	91,791 "	
		2,090,268 tons
		8,618,995 "
Add Anthracite Coal imported		951,883 "
Total coal consumption of Canada		9,570,878 "

as compared with 9,334,725 tons in 1901.

A comparison of the bituminous exports shows:—

	1901	1902
Great Britain	29,909 tons	19,986 tons
U. S. A.	1,395,142 "	1,854,753 "
Newfoundland	83,153 "	123,738 "
Other	65,457 "	91,791 "
	1,573,661 "	2,090,268 "

Having touched generally on the coal mining operations of Canada I shall now confine myself more particularly to the progress of

COAL MINING IN NOVA SCOTIA.

The coal field of Nova Scotia is divided into three distinct districts, viz.: Cape Breton Island, Pictou and Cumberland. The Cape Breton mines are within easy reach of the surface; the pitch of the seams is, generally speaking, very slight; they are comparatively free from fire-damp, little broken up by faulting, and altogether present the most favourable conditions for large outputs and low cost of production. Referring back ten years ago (1892) the total coal production of the Island of Cape Breton was less than one million tons. Last year (1902) the total production exceeded three and a half million tons, and of this quantity one Company—the Dominion Coal Company—are to be credited with three million tons. A gain of two and a half million tons in ten years is certainly not a bad shewing, but the next decade I predict will greatly eclipse these figures. With the exception of Old Mines, Sydney, and where safety lamps are used and blasting explosives prohibited, the mines are worked with open lights and black powder used for blasting coal; the mode of working is bord and pillar, coal cutting machines are rapidly displacing hand pick mining, the Dominion Coal Company producing no less than 76 per cent. of its total output by machines and the Nova Scotia Steel and Coal Company 33 per cent. and which will shortly be increased to 50 per cent.

CONDITIONS AT THE MAINLAND COLLIERIES.

In Pictou and Cumberland a different condition of affairs exists; the seams pitch at a considerable angle, anywhere from 16° to 40°; the seams give off considerable fire-damp, and with the exception of one or two small surface winnings, all the mines are worked with locked safety lamps, and where blasting is permitted none but the so called flameless explosives are used. The mode of working is both by bord and pillar and longwall, the latter being altogether adopted in the deeper seams of Pictou County. The total output of the Mainland Mines in 1892 was 903,979 tons, that of 1902 being 1,122,407 tons. The present year promises to show large increase of output for all the mainland collieries.

Pictou is famous for its thick seams of coal, the well known Foord Pit Seam showing a section of 34'7" of coal; and at the Albion Mines five seams show an aggregate thickness of 84 feet of coal. Cumberland County field has of late years proved to be much more extensive and important than geologists formerly gave it credit, and faults which were thought to exist and cut off a certain portion of the field have not materialized; large tracts of good coal have been found instead. At the Joggins, Bay of Fundy, there is a fine exposure of the measures, amounting to more than 14,000 feet, extending from the marine limestones of the lower Carboniferous to the top of the coal formation. The beds that appear at the Joggins can be traced northeastward for many miles. The total production for the County in 1892 was 456,229 tons, and that for 1902 was 555,170 tons.

PROSPERITY OF NOVA SCOTIA COAL MINING.

In round numbers the Nova Scotia mines produced during the past year 4,725 480 tons, found direct employment for 5 500 men and boys, of whom 2,500 were employed above ground and 6,000 below ground. Nineteen lives were lost in the production of that quantity of coal, or one life for about every 248,709 tons of coal produced. During the past year no gas explosion or serious accident has to be reported, and the loss of life occurring resulted from small and peculiar accidents, incident to all coal mines.

Comparative Table Showing Tons of Coal Produced and Number of Lives Lost:

COUNTRY.	Tons (2240 lbs. of Coal Produced.	No of Persons Employ'd	No of Lives Lost.	Lives lost per 1000 Persons Employ'd	Tons Coal produced per life lost.	Tons Coal produced per annum per person employed
United Kingdom*	220,000,000	493,133	1,018	2.06	216,110	446
United States†	261,000,000	433,331	1,508	3.48	173,077	603
Nova Scotia‡	4,725,480	8 500	19	2.23	248,709	556

*Assumed output for 1902, correct figures not at hand.
†Return for 1901 by U. S. Geological Survey.
‡Actual production, 1902.

UP-TO-DATE EQUIPMENTS THE RULE.

Comparing the mines and equipment in Nova Scotia of to-day with those of ten years ago, one sees great improvements. Mines then producing 600 to 700 tons were looked upon as satisfactory whilst to-day 1,000 tons output is only considered moderate, and at the largest pits two thousand and up to 2,700 tons are the rule; formerly old fashioned boilers carrying forty to sixty pounds pressure were the rule; now we have the latest and most approved time of water tube boilers working at from 100 to 150 lbs. pressure; large and improved up-to-date hoisting engines and large capacity ventilating fans; improved screening and picking plants; the best air compressing and electric plants are now the rule; also extensive shipping piers capable of accomodating the largest colliers, and where despatch is given second to none in the world. New and extensive mines are now being opened up and the outlook for Nova Scotia is bright and promising; its mineral wealth is great, and it is, therefore bound to become a great province.

IRON AND STEEL INDUSTRIES.

Not only in coal is Nova Scotia making a name for itself, but we have the large and important iron and steel works of the Dominion Steel Company, Lt., and the Nova Scotia Steel & Coal Company Ld., both turning out a product second to none in the world, and which is finding a ready market in Canada, the United States and Europe, and which it is claimed can compete with any similar product in the world. The amount of pig iron produced during the past year was 214,293 short tons; steel of all kinds 104 331 short tons.

GOLD MINING IN NOVA SCOTIA.

Then again we have the gold mines which produced 28,279 ounces of gold. There are now in process of construction throughout the various districts a number of large and modern plants, both for milling and mining on a large scale and to much greater depths than at present, and a considerable increase of production is looked forward to in the near future.

MACHINE MINING IN NOVA SCOTIA.

Taking the Coal Mines of Nova Scotia as a whole they compare favourably with the mines of the United States and Europe. Of course our mines are only in their infancy compared with either of the two mentioned countries, but I venture to predict that during the next ten years that as regards equipment and large outputs from individual mines, we shall not only hold our own but take the lead. To do this it behoves mine managers to be ever on the alert, fix their standard at a high plane, be ever watchful to make improvements and keep abreast of the times. Should they find themselves handicapped with obsolete plant and machinery, it should be relegated to the scrap heap, the question is not how much improved plant will cost, but what can be saved by making the change. We require in working coal mines to obtain the largest possible tonnage per man employed, and to do this and compete profitably with the rest of the world, Coal Cutting Machines must be employed, in every possible instance. Nova Scotia has started out in a very fair way to do this, for out of 4,725,480 tons of coal produced last year, no less than 2,300,000 tons or 49% was machine mined. This is a fair showing when we note that the United States is cutting 25% of its coal by machines, while Britain does not exceed 2%.

ELECTRICITY VERSUS COMPRESSED AIR.

Advance in science has done much in the past and will do still more towards the future successful operation of coal mines. Electricity for underground haulage, pumping, etc., is now better understood, and in the future must play an important part both under-ground and on the surface, and prove an indispensable adjunct to ecoaomy and efficiency; but in gassy mines I am inclined to think that compressed air will hold its own for sometime to come, and it is a question if the up-to-date stage compressors with intercoolers and working at high pressures are far behind electricity in point of economy, taking everything into account, and it is not likely they will ever be displaced altogether, as it is an absolutely safe motive power, easy to handle, and so far as coal cutting machines are concerned generally, is at the present time superior to electricity. On the surface where there are a number of scattered engines around the bankhead, workshops and sawmills, etc., there is no question that electricity is the power to adopt to ensure economy.

COAL DUST EXPLOSIONS.

Much has been learned in late years regarding coal dust as a factor in mine explosions, and to-day it is even more dreaded than fire-damp, seeing that a very small percentage of the latter in a dusty mine is capable in case of fire of propogating the most serious of explosions, and which will carry devastation from one extreme of the workings to the other. The only safe remedy for such mines is systematic watering of the roadways and the periodical removal of accumulation of dust, and this is a matter Mine Managers who have dusty mines and little gas to contend with will do well to bear in mind. While speaking of gassy and dusty mines it is my opinion that open lights and blasting with loose black powder should be strictly prohibited by law, and that the most improved safety lamps and some of the so-called safety explosives substituted; otherewise there can, though it may be long in arriving, be only one result—explosion and loss of life.

THE ANTHRACITE STRIKE.

The past year has witnessed one of the most severe and stubborn strikes in the history of coal mining in the United States. That disputes between Capital and Labor should have to be decided by such brutal methods is a reflection on this enlightened age. That the settlement of all labor disputes in future will be decided by arbitration or some other common sense method is the wish of all right thinking employers and employees. That labor organizations are lawful and have come to stay, may as well be recognized first as last; at the same time while unions have the right of organization they must be responsible in the eyes of the law and understand that in a free country a workman shall sell his labor as he pleases, and that without intimidation or coercion.

OUR HOME MARKET INDISPENSABLE.

Whilst the strike in the United States created an increased market for for Nova Scotia coal, and also gave it an impetus in our own market, not nearly so much coal was shipped over the border as many imagined would be the case; the home market being so good and the imports of anthracite having fallen off most considerably, the mines had all they could do without seeking foreign markets. Another result of the strike has been the

removal of the duty for one year on all coal entering the United States. That this is simply a temporary expedient to relieve the situation, and also has some political significance will not be denied, and there is no guarantee that at the end of the year it will be continued. No sooner was this action taken on the part of the United States, than many of our Ontario friends became excited and cried out that the Dominion should likewise remove the duty on bituminous coal - there bing no duty on either hard coal or coke entering Canada. Fortunately for the coal operators there are those governing at Ottawa who understand the coal situation, and have some idea of what the removal of the duty on coal would mean to the Nova Scotia mines, and it is not at all likely they will be influenced by the temporary removal of the United States duty. We have built up a good home market, a market steadily increasing, and we do not propose to hand it over to our neighbours. If the duty on Canadian coal were removed to-morrow it is not at all sure that Ontario would get her coal at any less cost than under existing affairs; that they receive no benefit or got it cheaper by the removal of the duty on anthracite is well understood by those in business.

In conclusion, I beg to thank the Council, Secretary and Treasurer for their very able assistance rendered me during the past year of my Presidency. (Applause.)

Major LECKIE—I would like to say a word, and that is I have much pleasure in congratulating the Institute upon the report of the council, showing that under your very able presidency, and with the aid of the secretary, whose services you have referred to, the Institute has made very great progress. In 1898 the membership was 192, and in 1902 it was much more than double that—453—and beyond question we are indebted to the untiring work of our secretary, Mr. Bell, for the very able way in which the Institute has been managed. Referring to your address, Mr. President, I may say that I know very well the conditions of the coal mining industry of Nova Scotia, and I have pleasure in saying that a great deal of the improvement in mining methods and mining plant is due to the initiation and example of the president of this Institute. When he came to Nova Scotia, he took hold of one of the most fiery and dangerous mines in the whole province. He has managed it not only successfully with great engineering ability, but also financially, and I think he occupies the strongest position in both respects of any man I know of in the coal trade of Canada. As to unions, we have no need to discuss these matters; but I might say that our president has been exceedingly successful in dealing with his men and avoiding strikes and strife, and that also is a very important feature of successful management. The principle which I always followed is the same as Mr. Fergie has spoken of. The unions have come to stay, and must be recognized; but the way to avoid strikes and trouble is to always urge the very best workmen to attend the union meetings, and not leave it to the shiftless and idle, who are very unsteady, but "have the gift of the gab," and do all the talking at these meetings. We know very well that when the best men control matters there will be very little trouble.

There is one thing I should like to say, and that is we had in Toronto lately what was claimed to be a mining convention, but it was a fraud. The people in Toronto know very little about our Institute, and I have urged our secretary more than once to hold one of our meetings at least in Toronto. I do not remember that we have had a single meeting there since the Institute was organized. It is due to the people of Ontario that we should have a meeting in Toronto, and I am sure that it would be well attended and quite as successful as any which we have recorded in our history here. Taking the Ottawa River as the division, there are nearly double the members west of the Ottawa that there are from the east, and therefore I think that the claims of Toronto have been very unfairly ignored. I suggest that we have the next meeting there.

The SECRETARY—With regard to Major Leckie's remarks I may say that we intend to hold a meeting in Ontario this year, as the report of the council shows. We should have had one at Sault Ste. Marie last year, but the members of the Lake Superior Mining Institute, whom we had invited as our guests, could not come. The difficulty of a Toronto meeting has been first, that there has been no really suitable hotel accomodation and our meetings have been held outside, either in the Parliament Building or at the School of Practical Science. Much of the success of the meetings here has been due to the fact that the members have been staying in the hotel, and we get them together very easily. We have been meeting here in this Club Room since 1889, under different organizations, and we have found it most convenient. Our meetings have always been successful, and I think we have been rather chary of taking chances of meeting any where else at this time of year.

Professor PORTER—There is one point in the president's address upon which I should like information: Has he ever worked out the number of deaths per ton of coal produced?

The PRESIDENT—I have the coal produced for life lost. I am taking the year 1901, as I could not get the figures for last year. The coal produced per life lost was: Great Britain, 216,000 tons; United States. 394,000, and Nova Scotia, 240,000. In this respect, therefore, Nova Scotia takes the lead. When, however, it comes to the coal produced per person employed, the United States takes the lead, and that is due to the large amount of machinery that is in operation there.

Dr. GOODWIN—Might I also ask a question? It has been said that the strike in the anthracite region leading to the use of bituminous coal in Canada, instead of anthracite, will lead to the permanent replacement of a portion of the anthracite. Have you been able to see any signs of it in your exports?

The PRESIDENT—I have very slightly myself; nothing like the extent that is claimed.

PRESENTATION OF PRESIDENT'S MEDAL.

Mr. O. N. Scott, of Listowel, Ont., who won the president's medal in the students' competition with his paper on "The Ore Deposits of Copper Mountain, Similkameen District, B.C." was then called forward, and in handing the medal to him, President Fergie expressed the hope that it would be the incentive to still further hard work on Mr. Scott's part. The two cash prizes of $25 each had, the president said, has been awarded to Mr. H. W. DePencier, of McGill, for his paper describing "Mine Timbering in the Old Ironsides and Knob Hill Mines," and to Mr. L. P. Silver, of Queen's, for his review of "The Sulphide Ore Bodies of the Sudbury Region."

THE PRODUCTION AND EXPORT OF CANADIAN MINERALS AND METALS.

Mr. B. T. A. BELL.—During the past two years I have endeavoured to present to this meeting such authentic figures as were available, showing the production and movement of Canadian minerals and metals during the year. I have here, open for the inspection of members, an immense amount of data, covering the year 1902. These figures show, notwithstanding a considerable falling off in the production of gold in the Yukon, and a shrinkage in value of over two millions of dollars in the mineral and metal production of British Columbia that the total value for the whole Dominion may be consevatively stated at $71,627,528, as compared with $70,122,525 in 1901. By provinces these returns show:—

	1902	1901
Nova Scotia:		
Coal..... 4,725,480 tons.....		
Coke ..... 382,989 "		
Pig Iron..... 214,293 "		
Steel ..... 104,331 "	$19,501,131	$13,000,000
Gold, Gypsum, Manganese, Grindstones, Baryest, Tripoli, Copper Ore and Building Materials.....	(In this estimate due regard has been made for Coal, Coke, and Pig Iron re-converted.)	
British Columbia:		
Gold... ..... $5,500,000		
Silver. ..... 4,000,000 ounces.....		
Copper .. .. 30,000,000 lbs		
Lead .. 23,000,000 lbs.....	$18,433,004	$20,713,000
Coal.... .... 1,750,000 tons		
Coke .... 128,000 tons		
Zinc, Platinum, Iron Ore, Building Materials		
Yukon:		
Gold.... .. .. $12,500,000 (returns given by Canadian Bank of Commerce Coal 2,000 tons, Silver, Platinum...	$12,600,000	$18,500,000
Ontario:		
Copper.. . . $686,043		
Gold 229.828		
Iron Ore..... 518,445		
Molybdenite .. 400		
Nickel 2,210,961		
Pig Iron..... 1,683,051	$13,577,440	$11,422,525
Silver... ... . 80,000		
Steel.... ..... 1,610,031	(After deducting value domestic ore smelted into pig iron and domestic pig converted into steel.)	
Zinc..... ... 11,500		
Non-metallic... 7,292,181		
Quebec:		
Asbestos and Asbestic. ..$1,500,000....		
Copper Pyrites, Chrome, Mica, Phosphate, Ferro Chrome, Iron Ore, Pig Iron, Steel and Building Materials	$4,000,000	$3,500,000
North-West Territories and Manitoba:		
Coal—Lethbridge.... 153,704 tons.....		
Blairmore..... 75,000 "		
Anthracite.... 16,550 "		
Canmore. .... 91,400 "	$2,515,953	$1,700,000
Souris. .. . 64,000 "		
Gold, Gypsum, Building Materials		

New Brunswick		
Gypsum, Copper, Manganese, Coal and Structural Materials	$1,000,000	$1,000,000
Total mineral production of Canada	$71,627,528	$70,122,525

The following returns have been compiled from the monthly Blue Books issued by the Department of Customs, and show the exports during the calendar year.

Antimony Ore	Tons	90	$13,658
Arsenic	Lbs	547,698	10,192
Asbestus	Tons	31,074	994,981
Barytes	Cwt	2,500	700
Chromite	Tons	740	7,535
Coke	"	60,568	180,915
Coal	"	2,092,268	5,402,235
Copper	Lbs	26,124,418	2,476,511
Felspar	Tons	7,374	13,699
Gold		..	16,921,861
Gypsum (crude)	Tons	289,600	295,215
Iron—Ore	"	428,901	1,065,019
" Pig	"	82,587	882,795
" and Steel—manufactures of		..	2,007,784
Lead	Lbs	17,761,484	457,170
Manganese Ore	Tons	162	4,062
Mica	Lbs	1,650,902	381,812
Mineral Pigments	"	703,297	6,182
Mineral Water	Galls	8,349	2,787
Nickel	Lbs	14,350,721	1,007,211
Oil, crude and refined	Galls	1,026	186
Ores—all other N. E. S	Tons	2,582	78,854
Phosphate	"	70	1,880
Platinum	Ozs	7	116
Plumbago	Cwt	17,725	23,094
Pyrites	Tons	18,584	50,178
Salt		..	3,798
Sand and Gravel	Tons	159,683	118,894
Silver	Ozs	3,422,390	1,823,058
Stone—building, freestone, etc	Tons	263,843	121,440
" ornamental and granite	"	676	3,389
" grindstones, rough	"	1,458	11,223
Other articles of the mine		..	282,735
Grand total			$34,667,169

The following figures compiled from the Trade and Navigation returns show the imports of our principal minerals and metals together, with one or two items, likely to be of interest to members of this Institute. The figures are for the fiscal year ended 30 June, 1902

Coke	Tons	266,140	$953,028
Coal and coal dust, Anthracite	"	951,883	4 239,693
" Bitiminous	"	3,300,199	6,509,071
" slack	"	505,930	267,344
Copper, and manufactures of		..	1,557,141
Iron Ore	Cwt	10,646,534	939,454
" Pig	Tons	75,134	1,105,972
* Iron and Steel, manufacture of	Dutiable		24,482,366
* " " "	Free		7,771,588
Mining and Smelting Machinery	"		$71,517
Wire rope, rigging, etc.	"		167,307
Lead, and manufactures of			874,769
Grand total			$49,739,250

I am aware that these figures do not correspond with the returns issued by the Geological Survey, but, nevertheless, I am quite confident they will stand the most careful examination, and that they will be found to be an exceedingly conservative estimate of the value of the business done by our mines and metallurgical works during the past year.

The PRESIDENT—I think we are very much indebted to Mr. Bell for the time and care he has taken to give us these figures; whatever differences of opinion there may be as to values, figures published twelve months after the close of the year cannot be of equal value to their issue within a month or two.

Mr. E. D. INGALL—Chief of the Division of Mining Statistics handed to the President a copy of the Advance Sheet issued by the Geological Survey, estimating the production of minerals in Canada during 1902 as $64,970,732 as against $66,970,732 in 1901.

The PRESIDENT—In view of Mr. Ingall's summary, I of course withstand my statement. At the same time it does not in any way detract from the figures which Mr. Bell has presented. There are doubtless differences in computing values.

Mr. BELL—I regret very much that Mr. Ingall has not given us an opportunity to examine the figures given in his summary. As stated I am prepared to justify the figures I have given, for the returns have been furnished to me direct from the mines, from railway and navigation returns, and from reports by the directors of our Provincial Bureaus of Mines. I see no reason whatever for altering my estimate of $71,000,000 as the value of our production in 1902. Mr. Ingall's figures of the production from the Yukon do not agree with the figures reported to me by the General Manager of the Canadian Bank of Commerce, and in my judgment his estimate of the value of our nickel output is altogether too high. The discrepancy between the figures quoted by the Geological Survey for this product and those given by the Ontario Bureau of Mines is most marked. The valuation of our nickel matte should not be quoted, as the Survey states it, at the New York market quotations for refined nickel, but as the value of the matte at Sudbury. In the Annual Report of the Survey for the year 1901, issued a week or two ago, it is stated that the total value of the mineral and metal production of Nova Scotia in that year was something like $8,000,000. These figures are too low and give the public an altogether wrong impression of the relative value of the mining industries in Nova Scotia compared with the production from the other provinces; moreover, I venture to say that the value of the coal output of Nova Scotia in that year, based on the selling price of coal in 1901 at the pits mouth alone exceeded the value of the figures which Mr. Ingall has given as the total production of the Province. There is an urgent necessity for better and more prompt publication of our mineral statistics and for greater uniformity in computing values. We have at Ottawa statistics published annually by Mr. Johnson, the Dominion Statistician, we have the annual reports of the Survey, we have monthly statements of exports and imports published by the Departments of Customs and Trade and Commerce, and, in addition to these, reports and bulletins issued periodically by the Mining Departments of the different Provinces. None of them agree, and in the interest of the industries which this Institute represents I take it to be our duty to call attention to these discrepancies.

Mr. E. D INGALL—As far as I can see the two statements practically agree. There is a certain difference of opinion as to the value to be put upon things. In Yukon gold, Mr. Bell says $12,500,000; we say $14,000,000. We had the former figures from one source and the latter from another. Looking at the whole matter, the figures are about as accurate as you could get them. The mint is the purchaser of the Yukon gold, and its figures have been adopted. We have got the value higher than Mr. Bell, who seems to think that we estimate things too low all the time. To go into a comparison of figures like these, one should have them printed and set side by side, and wherever discrepancies occur, they should be carefully looked into, and if they are actual discrepancies, and not merely differences in price and valuation, it is then time enough to cry out that there is something the matter with them. In valuing any product, it is open to a difference of opinion as to what point you should value it at, you only value large quantities at average figures. I must compliment Mr. Bell on his industry in getting together a mass of figures like these, but I really don't see that there is anything before the meeting which can be very well discussed, unless specific points are taken up.

The PRESIDENT What did you put down for coke, Mr. Ingall?

Mr. INGALL—$3.50. I might point out that we have not included in our general statement any pig iron produced from foreign ores, we have simply taken what was produced from Canadian minerals. Nearly all the items in our summary are made up from the direct returns from the producers themselves. When a producer says that he has made so much mineral, and that it is worth so much, you take his figures.

Mr. HOBART—The only reasonable or correct standard is the value of the metals in the ore or matte, or whatever form they are in at their final value. A standard is the main point; you must have a standard, and stick to it, or your statistics will be of no value.

The SECRETARY—I quite agree with you, but I say that the standard is incorrect. What is the standard value of nickel, or copper-nickel matte produced at the works at Sudbury?

Mr HOBART—I should put the value of it at the value of the metals contained.

The SECRETARY—At Sudbury.

Mr. HOBART—In the final form.

The SECRETARY—You cannot get final value until the matte has been refined at New Jersey.

Mr. GIBSON—The matter of statistics has come up at previous discussions at this Institute, and no doubt it is an important point. Statistics are practically to an industry what the barometer is with regard to the weather, or the patient's pulse with regard to his condition. They show whether an industry is prospering or the reverse. Statistics in order to be useful, must not only be published with reasonable promptitude after the expiration of the period to which they refer, but they must also be as nearly correct as they can be made. If there is any comparison of values between these two qualities, I would lay greater stress upon accuracy than promptitude of

publication. I think that the Geological Survey has for the last few years published its statistics with unusual promptitude after the close of the year. Its preliminary statement has been brought out a couple of months after the end of the year, and its final statement, in which much greater detail is given, usually comes out a year or a little more after the period for which it is issued.

With regard to Mr. Bell's statistics, and also with regard to Mr. Ingall's, as published in his preliminary report, if I wanted to criticise, I think I could point out some ways in which both are imperfect. For instance, Mr. Bell has included the value of all the iron ore produced in Canada, and he gives us the value of all the pig iron ore produced in Canada, and he gives us the value of all the pig iron produced very largely from that same ore. He also includes the steel which is produced from the pig iron produced from the iron ore; so that we have in this case the values duplicated at least twice. Again, we have the value of the coal given, and the value of the coke produced from the same coal. After all, it matters little what basis you adopt for the valuation of statistics, as long as it is understood; but if we wish to get an absolutely correct value of the mineral production of our country or province, I don't think it is right to include the same mineral in two or three different forms.

In the statistics of the Geological Survey, the item that Mr. Bell has taken exception to is, I think, properly open to objection. The value of nickel and copper in the nickel-copper matte produced in the Sudbury region should not be valued at the price of the refined metal in the New York market, any more than the price of a shipment of wool should be valued at the price of finished tweeds, or pulpwood at the price of the paper produced from it. I contend that the proper valuation to place on the nickel-copper matte of the Sudbury country is the value at which it would sell at the works at Sudbury, and that is the value which I have endeavored to put on it in the statistics I prepare from year to year. It varies according to the grade of the mat e. The value of the copper matte made at Sudbury now is worth more than it was a few years ago, because it is brought to a higher metallic value.

There is a good deal in the way in which you look at statistics. If you have the proper quantity before you, you can fix the valuation. For the purpose of Ontario, I think the value to Ontario is the value of the products at the time they leave the country, and not after all the additional labor has been put upon them in refining them into the actual metals.

Mr. B. T. A. BELL—In reply to Mr. Gibson I may say that in my statement I have, while quoting the figures of the output of coal, coke, pig iron and steel, made a generous allowance for the reconversion which Mr. Gibson has referred to. My figures have never been intended to be complete, but I do contend that they are a fair conservative estimate, suitable for the purposes of this annual meeting.

Major R. G. LECKIE—I quite agree with Mr. Gibson that the first essential is to have the quantity accurate, because values are very, very uncertain. Looking at the statistics which have been presented by the Geological Survey, I see the production of copper is put down at 39,000,000 lbs., and is valued at 11¼ cents per lb. In Canada it is not worth much over 9 cents. The value is continually varying. The production of nickel is put down at 10,000 000 lbs., and the value at $5,025,000, which is equal to 50 cents a lb. Half that price would be more than the value in Canada.

Mr. HOBART—While I don't want to take back anything I said a short time ago about the standard, I quite agree that quantities are the more important part. The determination of values is a very difficult matter, but if we have the quantities we have the main thing.

Mr. EUGENE COSTE—I am entirely of Mr. Gibson's opinion with regard to the valuation at the mines or works. That very fact explains a great deal of the trouble that seems to be between our secretary and Mr. Ingall. I think that much of that difference is entirely due to repetition in some cases and omissions in others, and that want of system is at the bottom of the whole thing. I have prepared a little paper on "The Collection and Publication of Mining Statistics," and perhaps the present would be a good time to read it. Mr. Coste then read his paper. (Reproduced elsewhere.)

Mr. HOBART—With regard to Mr. Coste's proposition, his point is all very well in one way—the satisfaction of mere curiosity—but it seems to me an unnecessary duplication of figures. The main object of statistics is to serve as a guide to the trade. The man who deals in copper does not care how much ore is produced; what he wants is copper. To go into all these figures of the production of ores is a multiplication of labor, without any useful purpose. The copper, as it comes from the mines, would in most cases have no value at all, unless submitted to concentration or smelting, or whatever may be necessary. I don't see the object of going into all these requirements, spending a lot of time and money, and more especially the time spent in collecting all these figures, when they are not going to do us a bit of good. I must also differ from Mr. Gibson, as I believe that promptitude is in many cases of more value than absolute accuracy. We cannot expect in any case absolute accuracy as long as we have men to deal with but if we can get it by March 1st, as the Geological Survey has done, it is worth much more to the average dealer, consumer and producer than it would be to have it absolutely accurate a year from now. One man, who deals largely in copper said to me: "I would rather know on February 1st, the amount of copper produced, within 5 per cent., than know the whole total two months later." I think you will find that opinion among all people engaged in trade.

Mr. B. A. C. CRAIG—I think the best way to state value would be to give it at some selling point and state how it had been determined upon. From my experience of Mr. Ingall, I have found him extremely persistent in his demand for statistics and figures. I don't think he has been at all lax, but I do think that almost any ordinary statistical returns that you pick up give little or no information, for the reason they don't set out in detail how they have been compiled. I think that Mr. Coste's suggestion is a good one.

Mr. BELL—Figures after all have but a relative value. The Province of Nova Scotia produced last year four millions of tons of coal but how many people realize what these figures mean to the trade and commerce of the country—the invested capital in land, buildings and plant, in wages, in the purchase of supplies, the rail and water freights, harbor dues and pilotage, in Government revenue from customs and royalty. Something more than a bald statement of figures should be given to the community so as to convey to the public proper estimate of the value of mining as a Canadian industry.

Dr. ROBERT BELL—In order to justify myself, I beg to state that I was the first collector of mineral statistics in this country, collecting them since about 1860. They were published in the *Montreal Herald* for many years and in the *Globe*, Toronto, as well as in the *Mining Journal*, New York, and the *Mining Journal*, London. Therefore I may, perhaps, be excused for taking up your time for a few moments. The difficulty in making accurate statistics can hardly be over-estimated. Anyone who has collected statistics knows it. Mr. Bell and Mr. Ingall are practically agreed as to quantities; the difference is in estimating values. If we are going into values, I think the value should be the worth when converted into some form in which we can compare it with other countries, the first tangible value itself. If you make a ton of iron ore into hair watch springs, it becomes worth $1,000,000 a ton. I believe that Mr. Bell is entirely sincere in all he has said, believing the same to be true, but it all depends on the way you estimate your values. I don't see why there should be any difference between the figures; we get them officially, and Mr. Bell gets them unofficially.

The SECRETARY—I beg your pardon; I get them officially. You are quite at liberty to examine my authorities. Here they are.

Dr. BELL—If the statistics are right as to quantities, all the rest can be easily adjusted.

Mr. CRAIG—I think there is more in this matter than merely collecting statistics, and without wishing to criticise the department, I doubt that perfection has been obtained by any means. If Mr. Coste would nominate a committee to deal with the matter, I would be very glad to second the motion, because I think it is of immense importance.

Mr. INGALL—I am glad to hear the suggestion of the last speaker, because it will put the suggestions which have been made in such shape that they can be acted upon. I quite agree with Mr. Craig that we are very far from perfection, but we shall get nearer to it if the practical men of the country will embody their suggestions in definite shape.

Mr. GIBSON—The suggestion that a committee be appointed to deal with the matter of statistics is worthy of consideration. It has always been our endeavor in Ontario to present the statistics fully and accurately. We have not always thought in the past, however, that we have been assisted as we might have been by the mining men of Ontario; but by dint of perseverance we have usually succeeded in getting approximately at the point at which we wanted to arrive. I am quite aware that the statistical schedules published by the Bureau of Mines and the Geological Survey at Ottawa are capable of improvement. If fuller details are wanted, we shall be happy to furnish them, if we can get them. If a committee is appointed, I shall deem it a privilege to co-operate with it.

Mr. OBALSKI—As inspector for Quebec, I should like to join that committee and give my experience on the subject.

Mr. COSTE—I don't quite agree with some of the speakers who look upon quantities as the most important point in our mineral statistics. From quantities we cannot make a total; we cannot add ounces, pounds, tons and barrels together. That is one point which, to my mind, forces us to settle down on some system and some values to be adopted in all the provinces of the Dominion, so that we can arrive at a total which will show the state of the barometer, whether it is rising or falling. It should not be very difficult to get at a standard of value. It is simple enough: What is at the mine; what is the state of the industry from year to year. If metallurgical works are increasing and a higher matte produced, we want to know it. It seems to me that the value should be taken at the mine or at the works every year, in the conditions in which the mineral or metal is sold by the works. We are then recording something which is happening at the time.

Mr. HOBART—I would like to ask Mr. Coste: "How are you going to get your values without getting your quantities first?"

Mr. COSTE—There are two ways of getting at values, but the most direct is to get them out of the books of the producer or miner. In some cases the mining men of the country are enlightened enough to understand the value of these statistics, and if they are quite sure that their particular values will not be disclosed and that their productions will only be grouped with others, so that their own business will not be published, in most cases producers, miners and smelters will take the values right out of their books. Very often you know the value better than you know the quantity. By the system I suggest, you can value your ore, your matte and your finished product, and you don't repeat. The great point in statistics, to my mind, is clearness, and by this system you are always clear.

The following Committee was appointed to deal with the main question and to report at the next annual meeting: Messrs. Fergie, Hardman, Coste, Bell, Craig, Gibson, Obalski and Haanel, with power to add to their number.

WEDNESDAY EVENING.

The members met at eight o'clock, the President in the Chair.

IRON ORES OF MESABI.

Prof. C. R. LEITH of Madison, Wis. opened the session with an interesting address on the "Iron Ore Deposits of the Mesabi district" the subject being well illustrated by lantern projections.

Mr. E. D. INGALL—What is supposed to be the relationship of the Mesabi Rocks to the rocks in the Thunder Bay district of Ontario? I have worked in the latter region and the slides shown were identical reproductions of those we had. I know that you have seen the two districts, and I was wondering what the relationship was supposed to be.

Prof. LEITH—We believe the two regions to be continuous. We have followed the Mesabi material from Gunthorpe Lake to Thunder Bay, and we have no reason for believing that they are not absolutely the same.

Prof. MILLER—We are under much obligation to Dr. Leith for coming such a long distance and giving us this paper. The subject of iron ores is a very important one in Canada at the present time, especially in Ontario; and I think that Quebec has hopes of finding iron ores. The district to the south-west of Port Arthur is being tested. There are two mills at work there for private parties, one of which, I understand, has Senator McInnes at its head, and the other is a Canadian company. The men who are doing work are experienced iron men, who have examined the district thoroughly. I think the district is promising. That is about the only area we have in Ontario that resembles very closely the Mesabi range. We have other ranges which resemble the Vermilion. These ranges practically surround Lake Superior on our side of the boundary. One range can be traced across the district of Nipissing for a distance of about eighty miles, and the western outcrop has attracted much attention lately in the township of Hutton. We are very pleased that an iron man of such high standing as Dr. Leith has come over and made some references to that district. One thing we lack in this country is knowledge of the deposits similar to those of Mesabi. It is no use sending an expert to examine deposits in our nothern district who is not familiar with those of Wisconsin or Minnesota, because they are unique. They send out experts from England occasionally to examine these districts, but they don't know much about them. We expect that great interest will be taken in our iron deposits during the next few years. Many deposits were tested last summer in a crude kind of way, and drilling was done on a number of outcrops. The only producer we have at present is the Helen Mine, in the Michipicoton district.

On the motion of Mr. Coste, seconded by the Secretary, a hearty vote of thanks was accorded Professor Leith for his address.

MINING IN ONTARIO.

Mr. T. W. GIBSON, Director of Mines,—It is not my purpose to speak at any length on this subject to-night, but I have in my hand the statistics of the mineral production of Ontario last year, and these will form a text on which I shall hang a few remarks to show what progress we have been making in that province during the year. It is not so long ago that people were sneering at the claims of Ontario to be considered a mining province at all. It was looked upon as being pre-eminently an agricultural province, and it is only in late years, comparatively recent years, that its claims to be considered a producer of minerals on anything like a considerable scale have been justified. He submitted the following comparative statement showing the output in 1902 compared with the previous year:—

MINERAL PRODUCTION IN ONTARIO FOR 1902.

PRODUCT.	1901.		1902.	
	Quantity.	Value. $	Quantity.	Value. $
Metallic:				
Copper.....lb.	9,074,000	589,080	9,864,000	686,043
Gold.....oz.	14,293	244,443	13,625	229,828
Iron Ore.....tons.	273,538	174,428	359,288	518,445
Molybdenite.....lb.	.....	.....	6,500	400
Nickel.....lb.	8,882,000	1,859,970	11,890,000	2,210,961
Pig Iron.....tons.	116,370	1,701,703	112,687	1,683,051
Silver.....oz.	151,400	84,830	145,000	80,000
Steel.....tons.	14,471	347,280	68,802	1,610,031
Zinc Ore.....tons.	1,500	15,000	950	11,500
Less value domestic iron ore smelted into pig iron and domestic pig iron converted into steel.....		5,016,734 400,000		7,030,259 745,000
Net value metallic output..		4,616,734		6,285,259
Non-Metallic:				
Actinolite.....tons.	521	3,125	800	6,150
Arsenic.....lb.	1,389,056	41,677	1,600,000	48,000
Building stone, etc.....	.....	850,000	.....	1,020,000
Carbide of Calcium...tons.	2,771	168,792	1,402	89,420
Cement, natural rock..bbl.	138,628	107,625	77,300	50,795
Cement, Portland....bbl.	350,660	563,255	522,899	916,221
Corundum.....lb.	1,068,000	53,115	2,273,211	83,871
Brick, common.....No.	259,265,000	1,530,460	220,500,000	1,411,000
Brick, paving.....No.	3,689,000	37,000	4,210,565	42,000
Brick, pressed and terra cotta.....No.	12,846,000	104,394	19,755,496	144,171
Feldspar.....tons.	5,100	6,375	8,776	12,875
Graphite.....tons.	1,000	20,000	1,923	17,868
Gypsum.....tons.	1,554	13,400	1,917	19,149
Iron Pyrites.....tons.	7,000	17,500	4,371	14,993
Lime.....bush.	4,100,000	550,000	4,300,000	617,000
Mica.....lb.	854,000	39,780	1,986,000	101,600
Natural Gas.....	.....	342,183	.....	189,238
Pottery.....	.....	193,950	.....	171,315
Petroleum.....Imp. gals.	21,433,500	1,467,940	21,630,000	1,600,000
Salt.....tons.	60,327	323,058	62,011	344,620
Sewer Pipe.....	.....	147,948	.....	191,965
Talc.....tons.	400	1,400	697	930
Tile, drain.....No.	21,592,000	231,374	17,510,000	199,000
Total Non-Metallic.....		6,814,352		7,292,181
Add net value metallic output.....		4,616,734		6,285,259
Total production.....		11,422,525		13,577,440

The mineral products of Ontario for 1902 considerably surpassed in volume and value the output of any previous year. The total of production was $13,577,440, an increase of $1,746,354 or 19 per cent. over 1901. Metallic products contributed $6,285,259, and non-metallic $7,292,181, both classes showing an excess as compared with last year's figures.

The chief increases were as follows:

	1901	1902	Increase
Copper.....	$ 589,080	$ 686,043.	$ 96,963
Iron Ore.....	174,428	513,445	344,017
Nickel.....	1,859,970	2,210,961	350,991
Steel.....	347,280	1,610,031	1,262,751
Stone.....	850,000	1,120,000	170,000
Cement.....	670,000	967,016	296,136
Lime.....	550,000	617,000	67,000
Petroleum products.....	1,467,940	1,600,000	132,060
Mica.....	39,780	101,600	61,820

And the principal decreases:

	1901	1902	Decrease
Carbide of Calcium.....	$ 168.792	$ 89,420	$ 79,372
Brick, common. ..	1,530,460	1,411,000	119,460
Natural gas..	342,183	189,238	152,945
Tile, drain.....	231,374	199,000	32,374

Notwithstanding some slackening of production at the principal nickel mines and works of the Sudbury region, the output of copper and nickel was the largest yet recorded, the former being 17 per cent. and the latter 35 per cent. in excess of the yield for 1901.

In iron ore there was also a large gain, the production increasing in quantity from 273,538 tons to 359,288 tons. and in value from $174,428 to $518,445. The bulk of the ore, as in 1901, was raised from the Helen mine, Michipicoton, where other important deposits of hematite are also in course of development.

The production of pig iron was slightly under that of 1901, blast furnaces finding it difficult to procure regular and adequate supplies of coke. The falling off as compared with the product of last year was 3,683 tons in quantity and $18,652 in value.

The very decided increase in quantity of steel produced from 14,471 tons worth $347,280 in 1901 to 68,802 tons worth $1.610,031 in 1902, was mainly due to the starting up of the Clergue works at Sault Ste. Marie.

Building and construction materials in the main show an increase, particularly stone, which includes also crushed stone for pavement use, and cement. The Portland cement industry is being firmly planted in this Province, where immense supplies of the raw materials for its manufacture exist. Eight plants were at work in 1902, and since the beginning of the present year another large factory has come into operation. Three or four others are under construction. In addition, natural rock cement is being made at four different establishments. The total output of cement rose from 489,288 bbls worth $670,880 in 1901 to 600, 199 bbls. worth $967,016 in 1902. There appears to have been a falling-off in the production of ordinary building brick.

Mica shows a large proportionate gain, while the output of natural gas has shrunk to little more than half the dimensions of 1901, in consequence largely of the withdrawal of permission to export this article.

The yield of petroleum remained almost stationary. The value given in the above table is that of the refinery products together with the value of the crude used for gas and fuel purposes, in which a much larger share of the product is now employed than formerly.

Mr. COSTE.—I should like to ask why, in the petroleum production, Mr. Gibson has used the finished product figures, instead of the raw material. The figures of $13,500,000, which Mr. Gibson quoted as the total mineral production of Ontario last year, include the petroleum in the shape of the finished material—parafin wax, lubricating wax, and so forth. I don't think that is right. You might get your production to $20,000,000, if you valued the products in that way. It gives a false impression. I would like to emphasise what I stated this afternoon, that there is no system to the thing. We want to know the mineral production of the country. We don't want to take a mineral product and value it up to its last limit, the finished article, and then call that the mineral production of the country; it is not the production of our mines at all. The sooner we realize that, the sooner we know what we are dealing with. There is no use our fooling ourselves, as the saying is, and I think that in this case we do.

Mr. GIBSON.—This question was gone into this afternoon at some considerable length, and I don't think it would be edifying to have a repetition of it. There is a difference of opinion in making up statistical schedules, and a committee was appointed to consider it and make recommendations, and I think that it might very well be left to that committe. One of the values of schedules of this kind is that one year's work can be compared with another and when you preserve the basis which has been adopted in former years, you can compare one set of figures with another. When you change the basis, you lose that advantage. Figures like these can only be approximate.

On the motion of the president, a cordial vote of thanks was passed to Mr. Gibson, and the session adjourned.

THURSDAY AFTERNOON.

The Meeting of the Institute was resumed at three o'clock in the afternoon of Thursday the 5th March.

Mr. Charles Fergie, President, occupied the Chair.

ECONOMIC GEOGRAPHY

Mr James White, C E., F.R.G.S. Dominion Geographer, Ottawa, presented a most interesting paper "On Economic Geography."

At the conclusion of his paper Mr. White said, pointing to the handsome map of the Dominion on the wall, recently published by the Department of the Interior: This map will be used to a certain extent in connection with the Economic Atlas. Before I left Ottawa I saw the Minister of the Interior and he gave me permission to say that a copy of this map properly mounted will be donated to the Institute, and that an unmounted copy will be sent to each member of the Institute.

The PRESIDENT (Mr. Fergie) said. We are all much indebted to Mr. White for his interesting and instructive paper and especially for what he promises in the future as regards maps and diagrams, which will be no doubt of inestimable value.

Major LECKIE.—I heard Mr. White's paper with a great deal of pleasure for it gives us a clearer idea of the resources of the country than we had before. The development of those resources come quite within our scope as an Institute. The water power of Canada is unrivalled in the world. I have been in Norway and Sweden for some years past, and after what I saw there I can say that Canada eclipses the world in the matter of water power. Really our water powers are the equivalent of our coal fields. Take the Sault and there you have the whole of Lake Superior as a mill pond, and the power that can be made available there is incalculable. It is equal to, I do not know how many thousands of tons of coal per year, and we have in all those rivers from Lake Superior to New Brunswick a water power which must represent an enormous amount of fuel. In the Lake Superior district and in North Ontario we have no coal but we have the equivalent in enormous water powers. The Department of Government which Mr. White represents is doing an immense service to Canada in bringing these things before the country.

Dr. GOODWIN—There is an interesting incident known to some of us which illustrates the point that water takes the place of fuel to generate power for mining and other purposes. Some of you who know the Cordova Mine know the amount of wood and coal that it took to generate power, but within a recent period they have developed a water power two miles away, and now they are independent of the coal barons to the south. That is a beautiful illustration of this very point, and that will be repeated over and over again in Canada as time goes on. In that way we solve the problem of cheap fuel.

Mr. WHITE—The branch of the Department of which I have the honour to be the head is to a large extent a new thing, and our first piece of work has been the large map of the Dominion. We also produced a smaller one on a scale of 100 miles to the inch. From this time forth we propose to develop as far as possible on the lines of commercial geography with the view of advertising the resources of the country. If we can place a copy of the Economic Atlas in each business house in Great Britain and the United States, it will do more to advertise Canada than anything else I can think of. If we can do that, it will be a revelation to 99 per cent. of the people of Great Britain and of the American Republic.

Mr. COSTE—I would like to congratulate the Canadian Government and the country on having secured my friend Mr. White for the position he now occupies at the head of this Topographical Branch. Some years ago Mr. White and I were on the same Survey and I learnt then to appreciate his ability. The difficulties before him are, no doubt, very great, but I have no fear but that he will overcome them. The importance to the country at large of first-class maps is self evident, but it is especially evident to those who have tried to make surveys with the existing maps and know their deficiency. The state of our maps has been deplorable up to date. I would like to ask Mr. White if a geodetic survey of the whole country is to be undertaken before long, so as to lay the foundation for very correct maps? I would like to see the work undertaken by the Dominion Government in a systematic way.

Mr. WHITE—I cannot really say whether the Department proposes to undertake a geodetic survey of Canada. For a great many years to come we will have to depend on what are called geographical surveys. These surveys carried on in the past have not been what they should be, and the information on our maps hitherto has not been as detailed as it should have been. What Mr. Coste refers to can only be accomplished by the expenditure of more money, but I have every reason to believe that it will come in time. The geodetic survey means the carrying of a triangulation over the whole country which is a very slow process indeed. There is no use in

having one Department doing a lot of work and another Department doing other work and overlapping each other. What I have always advocated was the formation of a Geographical branch which would undertake all this work and go into it with ability and expedition. The present system of letting the work out to different Departments results in a waste of time and a waste of money

On the motion of the President a cordial vote of thanks was tendered to Mr. White for his valuable paper.

THE STEWART RIVER GOLD DREDGE.

Mr. A. W. ROBINSON, C. E., of Montreal, presented his paper "On the Stewart River Gold Dredge" (reproduced elsewhere.)

Mr. J. E. HARDMAN—Might I have permission to question Mr. Robinson with regard to one or two technical points. He told us that his dredge was of the Californian type rather than the New Zealand type. Might I ask him whether these holes in the screen are of uniform size or whether some are smaller and some larger than the others. Those of you who read the Canadian Mining Review of last month may have noticed a comparison in the methods of dredging between the New Zealand type and the American type and the expression of opinion given thereon. Might I ask if the buckets in the Stewart River Dredge are close together, and if not, what is the distance approximately between the bucket pins?

Mr. ROBINSON—The holes are from an inch to three inches and are not of uniform size; at the lower end there are a few holes six inches by three. The size of the holes depends largely on the size of the stones to be dealt with. The buckets are open spaces with intermediate links and the capacity of the bucket is two and a quarter cubic feet. I was the first one to introduce the close bucket type for dredges built some years ago in Montana. Those who used them seemed to like them, and they claim that they work at bed-rock better than the buckets further apart. There are arguments in favor of both sides, but close buckets are heavier than the other system and not as well adapted for lifting big stones. Accidents happened on the Montana dredge by big stones getting between the buckets, but in this type of bucket that does not happen.

Major LECKIE—A year ago I was in New Zealand and saw the dredges at work there. The rivers are rather deep in that country and the sand free from boulders, so that they could use a different type of dredge. My friend Mr Errington, when he was up the Vermilion River in our Northern Ontario, found that there were a great many large boulders in the bed of the stream which would prevent the use of the New Zealand type, although on certain other rivers they might advantageously be used. It would appear that the machine would have to be modified to suit the conditions of each river. I was very much pleased to hear this paper read by Mr. Robinson. I happen to know the President of the company very well and I know that the financial affairs are in the best of hands. If this dredge does not succeed, considering the financial and mechanical skill displayed, then there is very little hope for success in that business.

Mr ERRINGTON—What size of boulders are handled, and is the ground loose or solid?

Mr. ROBINSON I think the gravel is comparatively loose. Of course we do not know what is beneath the surface, and as they have to work over a good many miles of river they would encounter all kinds of material. I may say that the dredge can come up against immovable rocks without injury to itself. We handle stones in that dredge up to 18 inches in diameter and pass them through.

Mr. ERRINGTON—How would you do when you came to large boulders? Do you work around them or up against them?

Mr. ROBINSON—You have to do the best you can, but in the hands of a skilful man there is no danger.

Mr. ERRINGTON—The gold on the Vermilion River is coarse enough to look at, but in reality it is comparatively fine: it is sort of flakey. On account of there being such large boulders there I was not aware that you could make any headway with a dredge of that kind.

A cordial vote of thanks was tendered to Mr. Robinson for his valuable paper.

REMARKS BY DR. LEDOUX.

The PRESIDENT—We have with us this afternoon a very distinguished visitor in the person of Dr. Ledoux, of New York, President of the American Institute of Mining Engineers, and I wish you to join with me in giving him a very hearty welcome.

Dr. LEDOUX, who was warmly received, said: I thank you in the name of the American Institute of Mining Engineers for welcoming me to your meeting. I have been a member of this Institute for a number of years and I always have great pleasure in attending your meetings. One of the most pleasant things is that you find so many men of one Institute who are members of the other. The relations of the American Institute with the Canadian Institute are most cordial and most friendly and they have been working largely on the same lines. I again express my pleasure in being with you.

ON THE MODERN BLAST FURNACE LABORATORY.

Mr. W. DICKSON CRAIG, of Midland, Ont., presented a most interesting paper "On the Modern Blast Furnace Laboratory and its Work."

The PRESIDENT—There are some chemical gentlemen connected with the Institute who are fully competent to discuss Mr. Craig's paper, but I regret they are not in the room at present.

Dr. LEDOUX—I have been making some notes while Mr. Craig was reading his paper, not because I had any idea of discussing it but in order that I might get some ideas for the laboratory in New York. I remember that in the laboratory in London they had extraordinary difficulties in their assays. They had their balances tested and tried everything to discover what the difficulties were, but at last they found that it was in some way connected with the electric light which affected the balance. When the light was some distance from the balance, one arm of the balance or the other would be suspended or lengthened, but when they did away with the electric lamp all these discordant results disappeared. I mention that as showing how careful we must be about the construction of the laboratory, and how we should watch the effects if it is illuminated with electricity. The desideratum is to get the light near enough to have the full benefit of it, and at the same time not too near to get heat from it. With regard to the floor being cemented we tried that in New York but we found in time that the friction would wear away the cement and our experience was that a very hard asphalt makes a better floor. The arrangements of the windows in the laboratory is a very important matter because you want to get light, and at the same time be able to keep the windows opened without having the wind blowing over the desk. As to the sampling of cargoes of iron and ore that is the most important point Mr. Craig has raised. If your sample is wrong there is no use making a careful analysis of it. I know that conscientious assayers have to meet competition from men who simply take a cigar box and fill it from a cargo and then say they have a proper sample. You cannot have too large a sample and, facilities for preparing it are equally essential. There are many ways of sampling cargoes of iron and ore besides merely taking a shovel full out of every tenth bucket. The old method of having a rod with knots on every two feet and having a man take a lump however small it might be, and putting it in the sample pile gave you a very fair sample. I am delighted to hear that in Mr. Craig's case they have taken such pains with their laboratory. Not only is it important for the works themselves to have the best analysis, but it is a matter of importance for those who sometimes have to stand between the buyers and sellers of ores and their products—sometimes we find that no matter how painstaking a man may be, another man may not be so painstaking and the tendency naturally is for each man to think that his own analysis is right.

Dr. GOODWIN—I am glad that interesting papers of this character engage the attention of the Canadian Mining Institute. I say that because I am a chemist myself, and I believe that we do not have half enough chemistry talk at our meetings I generally hear discussion about geology, and mining, and machinery, but very little about chemistry, and we all know that chemistry is a most important branch of the mining industry. Mr. Craig's description of the methods which have been adopted at the Midland Iron Furnace has value in several respects. In the first place it will be a valuable paper for students to consult in order to give them a clear idea of the kind of work they will have to undertake when they get into business themselves. The description of the methods which can be carried through in twenty-four minutes or half an hour will give the student a clear idea of the rapidity into which he will have to altar his slow fingered work while he is at the scientific school. Mr. Craig's suggestion as to what the Government might do in encouraging the selection of standard samples is most important. The description of the laboratory I found very interesting, and, like Dr. Ledoux, I made notes of the suggestions which perhaps I may be able to embody in improvements which are to be made in our own laboratory in Kingston. We are all much indebted to Mr. Craig for this interesting paper.

Mr. GEORGE E. DRUMMOND—I listened with very much pleasure to the able paper of Mr. Craig and I am pleased to know that Dr. Ledoux was able to express his commendation of the work we are trying to do at Midland. We have a great deal to do there before we make ourselves per-

fect, but there is one thing which I am sure you will have noticed and that is that we have a good chemist (applause). The chemistry of the thing is what we want to get down to in this country, and for that reason many of us who are engaged in manufacturing are beginning to take an interest in technical education. We have suffered in Midland, and I suppose others have suffered also, as to the methods adopted for sampling at the port of shipment as against the methods adopted at the port of delivery. The question of uniformity is a very important one. Chemistry is most important in our business and the manufacturers are beginning to realize that. In trying to make our laboratory at Midland as perfect as possible we feel that we are going on the right line. We try to have a good Superintendent and good workmen, and having heard our chemist you will see that we have succeeded in getting a good one.

On the motion of the President a cordial vote of thanks was tendered to Mr. Dixon Craig, for his paper.

ON SOME POSSIBILITIES IN CANADIAN MINING.

Mr. FREDERICK HOBART, M.E., of New York presented his paper on "Some Possibilities in Canadian Mining," (reproduced elsewhere in this Review.)

ON MINERAL STATISTICS: CANADA AND UNITED STATES COMPARED.

Mr. GEORGE E. DRUMMOND, presented a paper by Mr. George Johnson, Dominion Statistician, giving a comparison of statistics of mineral production in Canada and the United States.

Votes of thanks were tendered to Messrs. Hobart and Johnson for their contributions to the transactions at Institute.

THURSDAY EVENING SESSION.

The members met at eight o'clock. Mr. Charles Fergie President in the Chair.

THE VOLCANIC ORIGIN OF NATURAL GAS AND PETROLEUM.

Mr. EUGENE COSTE, E. M., Toronto presented a valuable paper on the subject of "The Volcanic Origin of Natural Gas and Petroleum"

Dr. ROBERT BELL—Mr. Coste has made out a theory that there may be a connection between petroleum and gas and organic phenomena, but I expected he would go further and show how all the elements are derived; how from the disassociation of the elements of other substances petroleum is formed.

Mr. COSTE—I do not pretend to be enough of a chemist to explain all the phenomena I have referred to. It is a pretty complicated problem, and I am afraid that we do not know much about the extent of the reaction which takes place down below. The only thing I point out is that we clearly see in the volcanic emanations these hydrocarbon problems producing the sulphur and these chloride emanations which we collect right from the lava itself, and the analysis of chloride sodium, carbonic acid, etc. There is no doubt at all that all these gases are contained in the lava itself and contained in the same way in the fluid magma emanating from these volcanic districts. I leave to future generations to say what the reactions are down below; I concern myself only with the geological fact.

Major LECKIE—We are all indebted to Mr. Coste for his very erudite paper, but I think it tries to prove too much. All these oils are not of regular chemical analysis. They vary in their constituents and in the proportion of their constituents. While not desiring to controvert this theory of volcanic origin, I think that there are evidences of oil having been produced from the shales. Take the Albertite in New Brunswick: Through the bituminous shales there, there are regular fractures and these fractures are filled with solidified petroleum. There is evidence that it has filtered in from the bituminous shale through which the fracture runs.

Mr. COSTE—There was pressure that would drive it in through the shales.

Major LECKIE—It does not require any pressure.

Mr. COSTE—You may drive anything through shales with weight.

Major LECKIE—We find that the fractures are filled by a regular infiltration. I can remember a discussion in this city at a meeting of the American Institute of Engineers when Mr. McFarlane, Chief Analyst of the Goverment, took the ground that a great deal of this natural gas and petroleum in Pensylvania was that the resust of the volatilization of the volatile matter of the bituminous coal; the conversion of bituminous coal into anthracite.

Mr. COSTE—There are millions of barrels of oil away down under the coal.

Major LECKIE—I think the oil has a different origin and that is very evident from the manner in which we find it to-day.

Mr. MICKLE—I would like to put this question as a conundrum: What is the difference between a man who believes the exclusively vegetable origin of coal and a vegetarian.

Major LECKIE—That is a puzzle.

Mr. HARDMAN—Perhaps Mr. Mickle can answer that himself.

Mr. MICKLE The man who believes in the exclusively vegetable origin of coal is prepared to swallow anything, and the vegetarian draws the line at meat. (Laughter).

Mr. COSTE—We have different beds of gas only 125 ft. apart, and they have been there for aeons of ages and yet the pressure has remained different as we find by our guages. That cannot be controverted in any manner, and that shows absolutely the imperviousness of these fissures. It is not all shale between; it is an impervious sandstone. It is impossible, as I pointed out in the paper, to imagine that these gases and oils which, have travelled side ways to the Anticlines, had been brought there without any pressure whatever to drive them. How could they travel through such strata as that, where they will remain for ages in that way without mixing at 125 lbs. difference of pressure between two strata only 125 ft. apart.

Dr. ADAMS—We are indebted to Mr. Coste for his very able paper. It contains so much that may be discussed with profit that we can hardly hope to do it justice within the time allotted to us. It is a paper which should be discussed by correspondence by each of us writing what we think on it, and having that put in as an appendix to Mr. Coste's paper. There is one thing which strikes everybody and that is, that the paper has been written by a gentleman who has been educated in France. We find that at the very earliest times the French geologists had always had the greatest respect for the earth's interior which none of us know anything about. For instance, in the case of the granite, when we get the granite through the shale we say that the granite came up in a liquid condition.

Mr. COSTE—That is not in my paper.

Dr. ADAMS—It is not, but Mr. Coste has derived from the earth's interior coal oil and all other things, and it is part and parcel of the same theory. We ought to be very thankful to Mr. Coste for the paper in which I can safely say he has got together every single fact that can be adduced in favor of the Volcanic Origin of Petroleum, and a good many which cannot be adduced in favor of it. With regard to the albertite, it seems to me plain that it is not volcanic at all. You have a series of shales in the Devonian of fossil fish which is supposed to be the origin of bitumen. In that case there is an anticlinel; on the side the shale broke as it naturally would and probably that was arched slowly. The crack was developed slowly, and probably ages elapsed from the time the crack first opened until we get it in the present condition. When you take the shales and turn them over slightly you find that the bitumen shows out. If you have this crack opened in a mass of shales saturated with bitumen, it seems to me it is reasonable to suppose that a certain amount will slowly ooze out of the crack, and as the crack widens it will fill up. There is no evidence of volcanic action about that. When they started the mine it was supposed to be coal and when they cut down the fine rock fissure vein that came out to a thin edge and disappeared instead of getting wider as it ought to if the stuff had come up. The company closed the works and the whole thing came to an end. It is impossible to try to explain any occurrence like that by the theory of emanations from below.

Mr. COSTE—The very fact that Dr. Adams has pointed out that the shales are impregnated with bitumen phenomena shows that the albertite vein was not formed by the drainage from the shale into the vein, because if it was there would be no petroleum in the shales now. If the oil of the shales drained into that fissure there would be no more in the shales. Show me in nature to-day where fossil fish produce oil. You have no right to admit that they produced oil in the lower carboniforous time when you cannot show it to me to-day You cannot show me any place to-day where the bodies of the fish are entombed; they are decomposed.

Dr. ADAMS—If I could take Mr. Coste down five or ten miles under the earth's crust I think I could show that process but unfortunately because our spirits are harboured in bodies that cannot pass through shales I cannot prove it. Perhaps in another world under more favourably conditions I can prove that.

Mr. COSTE—If they are not entombed at the time the formation is made on the sea shore how can you get it afterwards.

Dr. GOODWIN—I should like to point out that the human mind is prone to prepossession. There are illustrations of that on every hand and I

am very much inclined to think that geologists have a prepossession in favor of the organic origin of carbon and hydrocarbons in nature. That prepossession is very natural. The origin is that in nature as we have it on the surface of the earth, we cannot disassociate carbon and hydrocarbons from the leaf matter, so we say we get our carbon and our hydrocarbons, everything except carbon dioxide from this leaf matter and it is natural for geologists to rush to the conclusion that all these materials which we find in the crust of the earth have ultimately an organic action, lending a sort of appearance to the prepossession of which Mr. Coste has been accused.

Dr. ROBERT BELL.—I beg to move a vote of thanks to Mr. Coste for his paper. I do not think I ever in my life listened to a more interesting paper. As Dr. Adams has suggested, the members of this Institute should give their opinions on it by correspondence and this correspondence including Mr. Coste's paper would make a pamphlet of very great interest.

Mr. MILLER—I beg to second the vote of thanks to Mr. Coste. We are very proud of Mr. Coste in Ontario and as Toronto is his City I think the Institute might have one meeting there if only for educational purposes to let the people know what kind of an Institute we have. There are a great many questions asked about what we are by politicians and legislators. A great many people in Ontario seem to believe in the volcanic theory. We see that Professor Meikle believes in it: and he made up that conundrum at the time he was discovering the anthracite at Sudbury (Laughter). I had occasion to examine the well which they are putting down and when they got to the granite, I told them that it was time to stop but they went on and are going on still. They seem to think they will get oil down there. It reminds me of the story of the farmer who was digging in the ground and was asked if he was looking for a ground hog. He answered no, but he continued to dig and when he was asked: "What do you think you will get," he replied; well if I keep on I will get oil, hell, or China. (Laughter.)

The thanks of the Institute were accorded to Mr. Coste.

THE EXAMINATION OF MAGNETIC ORE DEPOSITS BY MEANS OF MAGNETIC MEASUREMENTS.

Dr. EUGENE HAANEL.—Dominion Supt. of Mines, Ottawa, was down for a paper "On the Principles Underlying the Determination of the Location and Extent of Magnetic Ore Bodies by Magnetic Surveys." Dr. Haanel announced at the opening of his address: I have changed the title of my paper. I find it would be scarcely of much value to speak in a summary way on the principles underlying the method, and as I wanted to make the paper more practical I have changed the title to "The Examination of Magnetic Ore Deposits by Means of Magnetic Measurements."

Dr. HAANEL delivered a most interesting and erudite address on his subject, which he illustrated by diagrams on the black board.

At the conclusion of the address

The PRESIDENT said: We are indebted to Dr. Haanel for his interesting and instructive paper. I am sorry we had not an opportunity to call upon him earlier in the day when we could have given him more time. Under the circumstances I do not think we have enabled him to do justice to his subject. There is no doubt that he has made the very best of it in the short space of time which he has had at his disposal.

Mr. INGALL—Dr. Haanel has given us an outline, and a very interesting one, of a handbook which he is going to write on this subject. I may say that he has got all the information that he could possibly get in such concise shape, that those of us who wish to follow up the Swedish method will have something to show us exactly how things may be done. I have no doubt that Dr. Haanel's book will be of great value to the mining men of this country. I have always held that in the Kingston and Pembroke districts, for instance, where there are so many bodies of magnetite, that had magnetic surveys been made many deposits would have been brought forward to our great profit. The information which Dr. Haanel will impart in his book will doubtless be of great use to the mining people of this country.

Mr. MICKLE—Could Dr Haanel tell with certainty the difference between a mass of rock 20 or 30 per cent. magnetite near the surface, and a body of magnetite at any depth below the surface?

Dr. HAANEL—I have indicated that it cannot be done in a case of that kind. That can only be done by boring.

Dr. GOODWIN—I realized last summer the importance of this method of magnetic survey. Dr. Haanel's clear and lucid explanation of the principles of this survey has removed certain doubts from my mind which I had as to its applicability. I trust that what Mr. Ingall has said about the publication of the hand book does not mean that we are not going to have the honour of publishing this paper in our Journal, because I think it would be very important indeed to have it published in the Journal of this Institute so that it may receive the widest possible circulation. (Hear, hear. I have much pleasure in moving that the thanks of the Institute be tendered to Dr. Haanel for his very important paper.

Dr. PORTER—I have much pleasure in seconding the vote of thanks to Dr. Haanel, and in doing so I should like to speak of my own experience in attempting to learn something of this method. I am not able to read the Swedish work on the subject in the original, and I have had considerable difficulty in the last year or two in getting any satisfactory information on the subject. I tried in England and Germany and failed. At McGil University, Dr. Adams and I have both appreciated the importance of this Swedish method and I might say that the Geological Department, under Dr. Adams, has recently procured some of the most modern apparatus for this magnetic survey and we are putting it in as a very important part of our Geological course. I think this field has been very much neglected until recently in this country, and we want to make the very best effort we can in the future to remedy our omissions in the past. Dr. Haanel's book will be welcomed not only by people who teach, but by many people in the field. I have had from my old students and from others many enquiries within the last year as to where in the world they could get information with regard to this method of survey, and heretofore I have had to send them a long list of very unsatisfactory references. I hope when Dr. Haanel publishes his book that I will be able to send them a single reference which will not be unsatisfactory.

The vote of thanks was enthusiastically passed.

The meeting adjourned at 11 o'clock to meet on Friday morning.

FRIDAY MORNING SESSION.

The Institute met at 11 o'clock on Friday morning in the library. Mr. Charles Fergie, President, occupied the chair.

An informal discussion took place as to where the next annual meeting should be held, but this discussion was renewed afterwards on a motion to hold the meeting in Toronto as appears by the report later.

ELECTION OF OFFICERS.

The scrutineers having examined the ballots, reported that the Officers and Council (see last number REVIEW) selected by the nominating committee had been elected.

MR. COSTE TAKES THE CHAIR.

Mr. B. T. A. BELL.—It is now in order that our new President, Mr. Coste, who by the declaration of the ballot, will fill the office for the ensuing year, take the chair. In Mr. Coste we have one of the oldest consulting mining engineers in Canada, and a gentleman who has consistently earned a very high reputation as an engineer and geologist. (Applause.) In so far as the proceedings of our Institute are concerned we may congratulate ourselves upon having on record two papers from him which are decidedly unique and original and distinctly creditable to Mr. Coste and to our Institute. (Applause.) I have great pleasure in moving that Mr. Coste now take the chair.

Mr. COSTE then took the chair as President of the Institute and was received with hearty applause and congratulations. He said: I thank you very much for the honor you have conferred upon me in electing me to be President of the Canadian Mining Institute, a position which has always been worthily filled by men of distinction in the past. My only fear is that I may not be able to discharge the duties of the office so well as my predecessors have done, but I assure you that I shall do my best. (Applause). With due regard to your choice I think you could have selected a better man, and indeed I see around me in this room many gentlemen who I think are more fitted for the position than I am. I should like to make a few brief remarks as to the progress of our Institute during the past few years. The figures given in the report of the Council show that we are in a very healthy condition indeed. We have now 453 members and our official publications are very creditable to the Institute and to the mining men of the country. Indeed, I may say, that from year to year our publications are improving all the time. We have always held good meetings and that is one of the things nessary to keep matters going. We also have a very satisfactory financial statement to present and a substantial balance on hand. We owe that in large part to the kindness of the Dominion Government in granting us an extra $2,000 last year and it is fitting for us to record our appreciation of this grant and to thank the Honorable Mr. Sifton, Minister of the Interior, for his kindness in that regard. We can also express the hope that at least the same grant will be renewed for next year. We want to get at least as much money as we had last year, because as our Treasurer

has pointed out, we have a good deal more to publish this year. In the discussion which took place, speaking about a meeting in Toronto, I referred to the fact that in Ontario they have never seen this Mining Institute, and some people there imagine that there is no such thing as a Mining Institute or no body of men chartered into an Association which represents the mining interests of the whole country from one end to the other. From that idea arose a very queer situation which was called to our attention in time by Mr. Bell, the Secretary, and fortunately Major Leckie was in Toronto, and there was a corporal's guard of us to tell the people up there that they should not imagine that they had credentials from all over the country. They had the gall to appoint a Credential Committee in Toronto and to represent themselves as a representative mining body of the Province. I think that is partly due to our mistake in not having occasional meetings in Toronto, and I trust that the suggestion made to have a meeting there will take shape. We will have a very fine new hotel there next year and you could not go to a better place. I conclude by thanking the members of the Mining Institute for the honor they have done me. (Applause).

THANKS TO MR. FERGIE.

Mr. J. STEVENSON BROWN—It would be in order now for some mining man to propose a vote of thanks to Mr. Fergie, who has so well presided over the Institute during the past year. I know something of the services which Mr. Fergie has rendered and I know that at very considerable inconvenience to himself he has travelled very long distances on several occasions simply to attend our Council meetings, a fact which shows that he took great interest in the society.

Mr. HARDMAN—Our treasurer desires that this motion should come from a mining man and in compliance with his request I have much pleasure in moving that the thanks, the most cordial thanks of the Institute, be given to Mr. Charles Fergie for the able manner in which he has presided over our meetings during the past year.

MAJOR GEORGE SMITH, M. L. A., seconded the motion.

The PRESIDENT—(Mr. Coste) In speaking of the progress our Institute has made during the past year, I should certainly have mentioned that this progress was due in large part to the efforts of our President Mr. Fergie. I ask you gentlemen to pass that motion with hearty applause.

The members of the Institute enthusiastically endorsed the motion.

Mr. HARDMAN—I beg to move that the thanks of the Institute be tendered to the Secretary and to the Treasurer both of whom have rendered valuable services and have been present at every meeting of the Council.

Mr. A. W. STEVENSON—I second that motion. It makes a very strong combination for the good of any society when you have such a Secretary, such a Treasurer and such a President as we had last year. I have no doubt that our Institute will continue to grow and increase and that we will have a membership of 1000 instead of 500 as at the present.

The motion having been put by the President it was cordially received and the thanks of the Institute were tendered to Mr B T. A. Bell, Secretary, and to Mr J. Stevenson Brown, Treasurer.

Mr. B. T. A BELL—While votes of thanks are in order we must not forget the services rendered to the Institute during these meetings by Dr. Porter. He has gone to great personal troubles to provide us with the use of an excellent lantern and in many other ways he has done much to promote the success of this gathering.

Mr. HARDMAN seconded the motion which was adopted.

The PRESIDENT in tendering the thanks of the Institute to Dr. Porter said that every year they had met in Montreal they had experienced uniform kindness from him.

Mr. B. T. A BELL—With regard to the proposal to move a vote of thanks to Honourable Mr. Sifton for the grant to the Institute, I may say that the Honourable Mr. Fielding has also been very considerate to us. We have already expressed in very clear and precise language our appreciation of the Goverment grant, and we all hope it may be renewed.

TORONTO FOR NEXT ANNUAL MEETING.

After some discussion a motion was passed recommending to the Council the desirability of holding the next annual meetings of the Institute in the city of Toronto.

MONTREAL BRANCH OF QUEBEC MINING BUREAU.

Mr. T. J. DRUMMOND—We have felt for a long time in the City of Montreal that it was very desirable and there should be a branch in this City of the Mining Department of the Quebec Goverment. A great many people who visit Montreal and who might be interested in our mining development often do not find it convenient to go to Quebec City, and if we could have the mining exhibits and information here it would be a great assistance. I beg to move seconded by Mr. Stevenson:

"Resolved that this institute through its officers urge on the Goverment of the Province of Quebec the necessity and importance of establishing in the City of Montreal a branch office of the Department of Mines. Such branch office to contain all necessary exhibits maps and other information in regard to the Mining interests of the said Province, and to be the Head quarters of the Director of Mines of the Province of Quebec, and under his immediate supervision. This Institute being of the opinion that the establishment of such an office in the City of Montreal would be in the interests of the Province of Quebec and of the Dominion at large."

I do not believe that it would at all interfere with the Mining Department if the Provincial Inspector of Mines had his headquarters in Montreal. If he were here it would be possible to get this information for those interested in mining matters who visit Montreal, and they could see at great convenience to themselves the exhibits and plans and maps. The carrying out of this resolution would entail little or no expense upon the Government. I believe that if the Institute passes this resolution it will be favourably considered by the Provincial Government.

Mr. A. W. STEVENSON—There is no politics in this; it is simply a business consideration. We have already interviewed the Quebec Government and they appear to be generally in favour of the proposition, but of course we have a very economic Government in this Province, and it may be that the question of possible expense bothers them more than anything else. An expression of opinion by this Institute might help the Minister in arriving at a decision.

Mr. OBALSKI, Inspector of Mines, Province of Quebec—I would like to say a few words on the question as I am somewhat interested. I find quite an unanimity of opinion on this subject, and I have been approached by several members with a view of getting my opinion. Some years ago I had some objections to come to Montreal for a private reason, and also because I had charge of the Administrative work of the Department. Now we have a very efficient officer in Mr. Coté who has charge of the administrative part of this branch. Our province as you know extends from Temiscaminge to Gaspé, and I think it would be very convenient for the mining community and for people visiting our country to have an office here. For my part I would be willing to come to Montreal. I have been twenty-two years in the service of the Government; I have done my best in the past and I intend to do the same in the future. I have no doubt but that the Government will consider this matter carefully.

The PRESIDENT—You all seem to agree on this point and I myself believe that it would be a great benefit to mining interests if we had an office of the Inspector of Mines for Quebec in Montreal.

The resolution was adopted unanimously.

STUDENTS' AWARDS.

The SECRETARY—I wish to make an announcement with regard to the Students' competition. I think that the committee on awards would be more effective if it is a small committee. We have divided the awards into three classes. It is one of the perquisites of being the President of the Institute that he has to give a gold medal every year, and the President's medal is given for the best paper contributed during the year. We have divided the subjects, one under Mining, one under Ore Deposits and Geology; and the other under Ore Dressing. I would suggest that the awards in the mining and metallurgical section should be left to Messrs. Coste and Hardman, and that the geological section awards be left to Dr. Adams of McGill, Prof. Walker, of Toronto and Dr. Goodwin of Queens. I think this will make a very good committee.

The PRESIDENT—In regard to the medal I may say that I will be very pleased indeed to contribute the usual medal and in fact I look upon it as an honor to be allowed to do so.

The Committee named by Mr. Bell was appointed.

FRIDAY AFTERNOON SESSION.

The Institute re-assembled on Friday afternoon at 3 o'clock.

The President, Mr. Coste, occupied the chair.

NICKEL DEPOSITS OF NEW CALEDONIA.

Major R. G. LECKIE, of Sudbury, Ont., read his interesting paper, "On the Nickel Mines of New Caledonia." Major Leckie spoke from a personal examination of the mines and gave facts and figures of deep concern to the nickel industry in Canada. He also exhibited some very interest-

ing photographs of the mines and their working, which were taken on the ground.

The PRESIDENT—We are all deeply indebted to Major Leckie for his paper, which is so interesting, and so much to the point, there being a similar association of rocks with the nickel found in our own country.

Major G. R. SMITH—I have listened with the greatest interest to what Major Leckie has said in connection with the nickel mines of New Caledonia, and with the hope, as he suggest that it may lead to some further development of our deposits in the Eastern Townships, although I am frank enough to say that there does not appear to be enough work done in the Eastern Townships to start a company on yet. When we see that they are working with such low grade ores in Caledonia there is no hope for us.

Prof. MILLER—Major Leckie is well qualified to give us a description of the New Caledonia mines, and to make this comparison with Quebec on account of his earlier experience in that province. I must say that it is a very valuable comparison indeed. It is always interesting to have our own mines compared with those of other places, even if we have not found very much in any one locality in Quebec yet.

Prof. MICKLE—Did I understand Major Leckie to say that there were a great many nickel deposits in New Caledonia that are still undeveloped.

Major LECKIE—Oh no.

Prof. MICKLE—But none of them extend to any depth.

Major LECKIE—No.

Prof. MICKLE—Would the quantity be immense.

Major LECKIE—Oh yes. There is one place where the International Nickel Co., bought about 8,000 acres all covered with more or less of this silicate of nickel. There is no blasting required there; it simply is necessary to have an efficient Chinaman to pick it up. The work is done by pick and shovel.

The PRESIDENT—How many miles does the range extend?

Major LECKIE—The known range is about three quarters the length of the Island, or 380 miles, it is very continuous.

Mr. EVANS—Do I understand that the depth of the deposit is about 20 feet.

Major LECKIE—Yes; and after that you get into the pure serpentine.

Mr. EVANS—20 feet would be the maximum.

Major LECKIE—Yes; 20 feet or 25 feet would be the maximum.

Mr. FERGIE—How would you compare these mines with the mines in Canada.

Major LECKIE—The best mines in New Caledonia would hold their own with the best mines in Canada. There are only one or two mines in Canada that would equal them in cost of production.

Mr. FERGIE—I understood you to say that there was 25 per cent. of moisture in the New Caledonia oars.

Major. LECKIE—Yes; from 10 per cent to 25 per cent. There is no water in the Canadian; it is a hard sulphide.

Prof. MICKLE—Not the Canadian but the New Caledonia, because it is free from sulphur and phosphorus. The only metal associated with nickel there is iron so that if it were smelted you could form a ferro-nickel. Experiments have been made and it yielding fero nickel carrying 48 to 52 per cent of nickel and the balance iron. There are immense quantities of iron there. The difficulty in making the ferro-nickel from our Canadian ores is the amount of sulphur they carry, and also copper. Because you could make a ferro-nickel for the use of steel-makers you must have it entirely free from sulphur which is fatal to steel. Copper also is very injurious to steel. You could use up to one-tenth of one per cent of copper but it is a very costly thing to get rid entirely of the copper from the matte. Dr. Mond extracts the sulphate of copper and then treats the residue with the carbonic oxide and dissolves the nickel in that way and a certain amount of iron is carried over with the nickel. But if the matte can be brought into a condition where nothing remains but iron and the nickel you could then fuse that at once and make a ferro-nickel and save a very costly process, namely, the fusion half a dozen times with the sulphate of soda in order to separate the nickel from the copper. The ores of New Caledonia being quite free from sulphur and copper and phosphorus they lend themselves very readily to the production of ferro-nickel of high grade.

Major LECKIE—Formerly the French Company did some smelting in New Caledonia, and the product was rather an infusible mixture. We know that the silicate of any metal is rather difficult to work; it is not like adding the oxide. The great consumption of nickel now is not as metalic nickel, but they use it as an oxide or as a ferro-nickel for making steel rails, armour plates, and all that sort of thing. There is no necessity for getting rid of the iron if you could give a ferro-nickel perfectly free from sulphur and free from copper. That is the problem before our Canadian metallurgists. It is to get rid of the sulphur and the copper and form ferro-nickel. Mr. Clergue has tried it and failed, as I told him he would, some years ago.

Mr. BROCK—Major Leckie has done good service in calling attention to this formation of nickel. The districts which may be prospected for this nickel are not confined to the Eastern part of Canada. As has been pointed out, there are similar nickel deposits in Oregon, and in British Columbia there are immense areas of this Serpentine. A great part of British Columbia as you know has not been carefully worked over geologically but in the Atlin district large areas of Serpentine are also known to occur and this pyrrhotite Serpentine is very similar to that in the eastern townships and in New Caledonia. It contains such minerals as Chromite and in parts of British Columbia, as in the Similkameen, it contains platinum. In some of the districts it is a brown material which resembles the ore of New Caledonia. It would be well for prospectors to bear in mind the possibility of nickel occurrences in these Serpentines. The basic rocks of the Sudbury District are closely allied in composition to this pyrrhotite, the difference being that they are not quite so basic. From some experiments on these rocks it is known that nickel does occur in small quantities in some of the basic minerals constituting these rocks.

The PRESIDENT—I was in hopes when Major Leckie described the superficial deposits in New Caledonia that we might hope to see an end to it before very long in order that our Canadian deposits would be more valuable. That is a selfish idea no doubt, but it is a very natural one. However when Major Leckie further said that the deposits were found 150 miles in length, I am afraid we will have something to tackle in trying to keep our end up. On the other hand I am very much consoled by Mr. Brock's view that we have not only these magnesian igneous rocks in the eastern townships but also in British Columbia, and all along our Pacific Coast, more or less.

The thanks of the meeting were accorded to Major Leckie.

PRIMITIVE MINING AND SMELTING IN INDIA.

Prof. T. L. WALKER of Toronto University delivered an address "On some Primitive Methods of Mining and Smelting in India (Illustrated by lantern projections).

Prof. WALKER spoke from personal experiences in India and Ceylon and his photographs taken by himself on the spot portrayed the primitive methods of gold washing, iron smelting and mica mining. He pointed out how whole families were engaged in this labour and were paid at the rate of 2 cents a day each while the manager of a mine would get $5.00 a month.

At the conclusion of the address, in reply to questions he stated that in the mines represented by the Government of India there was a royalty of 10 per cent and in mines which belonged to the great native princes the mining was done as a matter of bargain. When the mica was shipped to England and sold, the bills of sale were returned and the royalty was collected on that. Prof. Walker also explained the geological formation in which the mica was found in India.

A cardial vote of thanks was tendered to Prof. Walker.

Mr. W. J. MILLER, Provincial Mineralogist, Toronto was on the syllabus for a paper on "Notes on the History of the Mineral Industry in the Nineteenth Century."

As the time was limited Prof. Millar gave but a brief summary of his paper and he illustrated, by diagrams, the production of minerals in different countries during the last two centuries

The address of Professor Miller was most interesting and at its conclusion the President in tendering the thanks of the Institute to him, regretted that time did not permit to hear the paper read *in extenso* but that they all felt there would be much benefit derived from it when it was printed in the Journal of the Institute.

The meeting then adjourned.

ANNUAL DINNER.

The Annual Dinner in the evening was one of the most successful functions held by the Institute and was largely attended.

Velvet Rossland.—The manager cables:—"Have received the following returns from smelters, namely:—226 tons first-class ore yielded 205 ozs. gold, 19,100 lbs. copper. Net returns from smelters $4,370, or an average of £4 per ton."

LE ROI.

Nanager Mackenzie Gives Some Valuable Information to the Shareholders showing the Position and Prospects of the Mine.

At the annual meeting of the Le Roi Mining Company held in London 30th January last, some interesting information was presented to the shareholders. During the months since the end of the financial year, viz., from July 1st to December 31st, 1902, the returns furnished by the General Manager show that the profits during that period amounted to about $450,000. Considerable interest will be taken in Mr. Mackenzie's report, which we reproduce in full as follows:-

"Your Company's mineral claims at Rossland, British Columbia, consist of the Le Roi, Black Bear, Le Roi Star, Pearl and Ruby, containing in all 71.44 acres.

Within the area above-mentioned are three important veins known as the "North," "South" and "Middle" respectively.

Middle Vein.—This is the main vein, and upon it is located both the old and the new shafts, the latter being the main working shaft through which all mining operations are carried on, the North and South veins being reached by cross-cuts. The Combination Shaft has reached a depth of 1,284½ ft., and extensive exploration work is being carried on in the 9th, 1,050 and 12th levels. As the work on the latter level has only just begun it is impossible to predict whether or not valuable discoveries of ore will be made at this point. On the 1,050 level, at about 125 ft. east from the Main Shaft, a body of ore of fair shipping grade has been developed, the shoot being 62 ft. long, with an average width of 10 ft. Between the 9th and 1,050 levels, west of the Main Shaft, a body of high-grade ore is being opened up by a winze from the 900. This winze is down 75 ft below the 900, and is in ore the whole distance which will average $18 per ton. By judicious exploration work above the 7th level, I believe a considerable tonnage of high-grade ore can be developed between, and adjoining, the stopes now being worked. In the haste to attain depth and explore the lower levels much virgin territory has been left between the Tregear Shoot on the extreme western limits of the known ore body and the Miller Shoot which adjoins the Centre Star Mine on the eastern boundary.

South Vein.—This has been developed by cross cuts at the 5th and 7th levels, and a large tonnage of ore is blocked out that will realize a profit when operating expenses are reduced to $9 per ton, or the value of copper rises to 15 cents per pound. A raise on this vein from the 7th to the 5th level proves that the ore body is continuous between them, and contains average values of $8 per ton—proper sorting will bring the shipping grade up to $10 per ton.

North Vein.—The outcrop of this vein at the western end is very promising, and should be further prospected to determine its value. Although it is small it carries high values in gold and copper. The vein is intersected by cross-cuts on the 4th, 7th and 9th levels, but no exploration work has been done under where the outcrop is most promising.

ORE RESERVES.

Mr. R. J. Frecheville, M.E., in his report to the Directors and Shareholders of your Company, dated December 4th, 1901, estimated the ore reserves of shipping grade at that time as 483,872 tons, valued at $11.75- the basis of values being: Gold at $20 per ounce, silver 60 cents per ounce, and copper 16½ cents per pound. The present prices of these metals are: Gold $20 per ounce, silver 53 cents per ounce, and copper 11½ cents per pound, which reduces the value of these reserves to $10.37 per ton. From the date of Mr. Frecheville's report an additional tonnage, amounting to 93,121, of an average value of $10.26, has been developed. The extraction during the same period was 129,635½ tons, containing gross values of $1,517,664 66, equal to $11.70 per ton. By making due allowance for the fact that the grade of ore extracted was higher than the average of the mine, I estimate the reserves at the close of the fiscal year at 447,358 tons of an average of $9.96 based on the present values of metals.

A survey of the second-class dump shows that it contains $4,000 tons of ore, and several carloads taken as a sample indicate a value of $7.50 per ton. A small dump adjacent to the old shaft contains 3,000 tons of ore, which, judging from the returns of a quantity already shipped, carries values equal to $12.50 per ton.

ORE PRODUCTION, ETC.

The ore mined and shipped to Northport during the year amounted to 155,765 407 dry tons, its metal values averaging: Gold .373 ounces, silver .709 ounces and copper 1.526 per cent. per ton. The gross value of this ore was $1,821,773.05, equal to $11 695 per ton. The location and area of the ore extracted is shown by heavy black contour lines on the vertical projection of the workings which accompanies this report.

The mining operations embrace only a period of 263 days, as during the months of July, August and September practically no work was carried on owing to the "strike" existing at your mine and smelter.

There were shipped to the smelters at Trail and Northport, during the year, 14,333.101 dry tons of second-class dump ore, which contained average metal values of: Gold .377 oz., silver .485 oz., and copper $27 per cent. per ton. The gross value amounted to $147,517.36, equal to 10.29 per ton.

Assuming that the average value of the ore mined during the year was $11.695 per ton, and deducting the operating expenses for the same period, $10.652 per ton, a profit of $1,043 is shown to have been made on the first class ore, equal to $162,460.00. The gross value of the second-class dump ore treated during the year was $10.29 per ton, the total expenses incurred in connection with same was $5.35 per ton, leaving a profit of $4.94 per ton, equal to $70,830.00. The total profits, therefore, amounted to $233,290.00.

WORKING COSTS.

Messrs. Price, Waterhouse & Co., your auditors, in their report, gave our total operating expenses, which embraced mining, freighting of ore, smelting and realization of matte values, for the year ending June 30th, 1901, as $10.724 per ton. Apparently, they failed to make any allowance for the regular metal losses in slag, as is shown by the subjoined table, which gives the comparative costs under this head for the years 1901 and 1902:—

	Per Ton. 1901	Per Ton. 1902
Stoping and loading on railroad	$3 487	$3 100
Exploration	423	.451
Depreciation:-		
Mine equipment	080	.138
Surface improvements	050	061
Mine machinery	166	125
Freight on ore to smelter	510	.400
Smelter expense	4 465	4 205
Depreciation of smelter plant	232	119
Interest and discount on ore in yard and matte in transit	229	233
Freight on matte to refiners	536	404
Sacking and crushing matte	044	043
Eastern representation, assaying, &c.	028	013
Refiners' tolls and deductions	534	579
Metal losses in smelting	...	781
	$10 724	$10 652

Although nearly $53,000 of the exploration costs carried forward in Capital Account from the years 1900 and 1901, have been charged to the present year's cost, and an extremely liberal allowance made for the depreciation of the development performed in 1902, the cost of mining and smelting was reduced 74 cents per ton, in spite of the fact that the tonnage mined was nearly one-fourth less than that treated during the previous year. The metal losses in slag, however, which were not taken into consideration in that period, more than offsets this saving.

The working costs of the year do not provide a correct index of what can be done in the future, as I believe that under reasonably favorable conditions the costs can be cut down to $9 per ton. We have been heavily handicapped by labour troubles, besides high freight rates and fuel costs, which I have every reason to believe will be reduced in the near future.

REVIEW OF MINE EXPENDITURES.

During the year the gross expenditures for operating and equipping the mine amounted to $593,896.93.

The amount expended on Revenue Account segregated as below was		$487,009 77
Stoping ore from mine	$482,500 60	
Loading second-class ore	4,509 17	
The amount expended on Capital Account segregated as below was		106,887 16
Mine machinery and plant	$ 6,453 74	
Surface improvements and buildings	6,477 75	
Furniture	2,205 84	
Surveyors' and assayers' instruments	949 55	
Mine equipment	6,763 93	
Exploration and development	84,036 35	
The sum charged to "Profit and Loss," distributed as follows, was		$605,131 78
Stoping ore from mine	$482,500 60	
Depreciation:		
Exploration and development	71,998 20	
Mine equipment	21,558 88	
Machinery and plant	19,483 22	
Surface improvements and buildings	9,590 88	

During the year the sum of $84,036.35 was expended in the development of the mine. The details of the work accomplished, and costs, are as follows:—

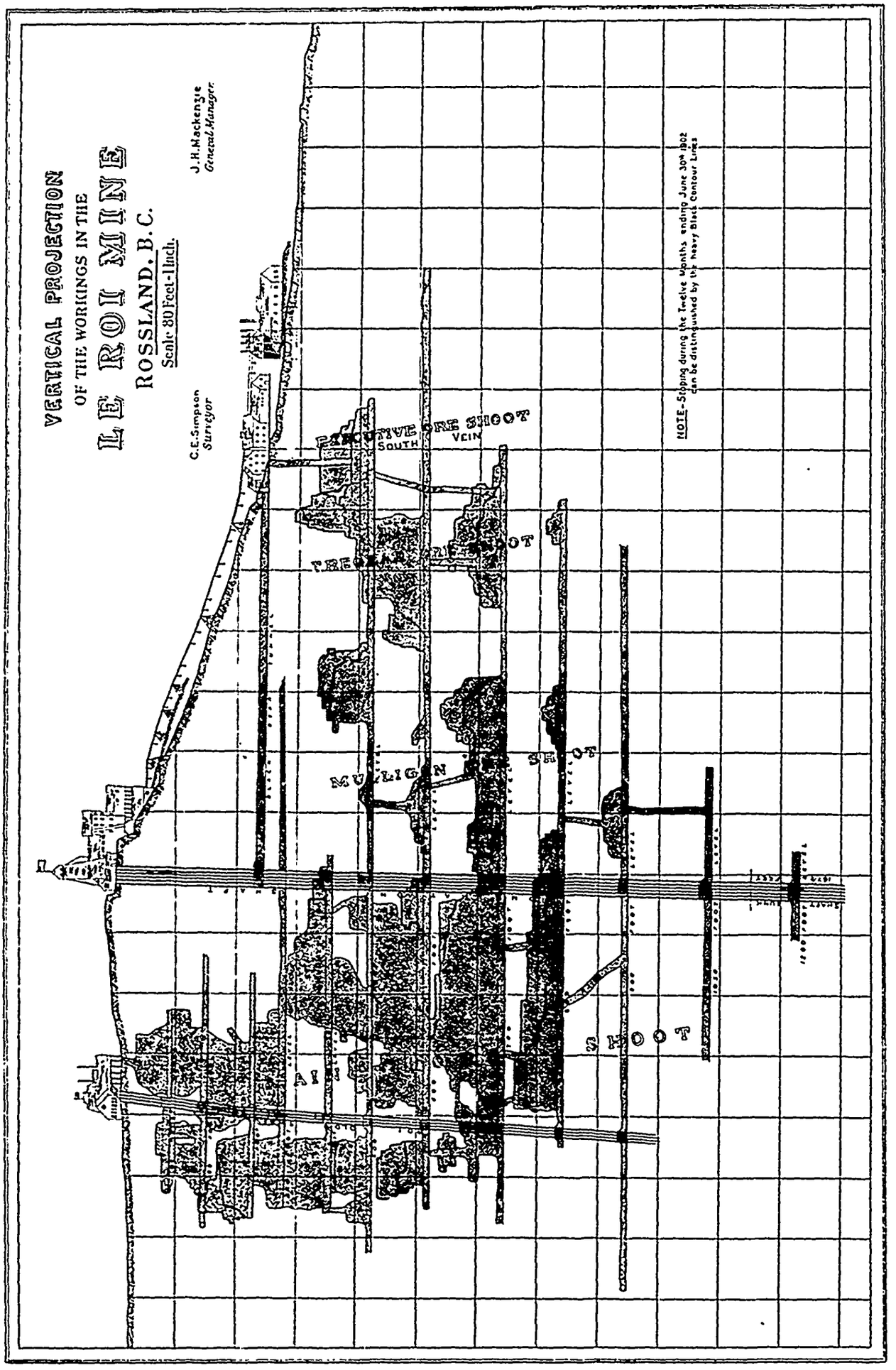
WORK.	FOOTAGE.	TOTAL COST.	COST PER FT.
Sinking shaft	167½	$17,920 59	$106 99
Station cutting	....	2,396 17	.
Pocket cutting	....	6,182.93	....
Winzing	75	3,548 79	47 32
Raising	591½	18,803 54	31 79
Cross-cutting	420	7,947 73	18 92
Driving	1,495	25,343 92	16 95
Diamond drilling	374	1,892 68	....
Total	3,123 ft.	$84,036 35	

The accompanying plan shows the above workings wherever possible. They can be distinguished by heavy contour lines.

THE NORTHPORT SMELTING WORKS.

These works are situated at Northport, Washington, and are owned by your Company. They are distant about 17 miles from the Le Roi mine, with which they are connected by the Spokane Falls and Northern Railway, a branch of the Great Northern System. The location is considered to be an excellent one, as the smelter is always assured of an unlimited quantity of lime rock, particularly well suited for fluxing purposes, at a nominal cost; and a constant and adequate supply of water for the general uses of the plant as well as for carrying off the slag. The transportation facilities of Northport are already good, but an additional advantage will be gained during the present year, as the branch line of the Great Northern Railway which is to be connected with the Crow's Nest Pass coal field will shortly be completed and the smelter enabled to obtain ample supplies of first-class coke at a reasonable rate. If good business judgment and economy is exercised, there is no reason why much profit should not accrue to the Company from the treatment of custom ore, as with the many points in our favor we should eventually be in a position to secure much of the ore produced in Washington, Montana, Idaho, Oregon and British Columbia.

The full capacity of the plant provides for the treatment of 1,200 to 1,500 tons of ore daily. It consists of six large water-jacket copper matting furnaces, one of which has but recently been erected, three calcining furnaces, rug mills, briquetting machines, etc. The ore is taken from the roast yards to the bins at the back of the furnaces by means of a small locomotive, and the tracks are loaded at the heaps by a steam shovel. The various mechanical appliances are in first-class condition.


VERTICAL PROJECTION
OF THE WORKINGS IN THE
LE ROI MINE
ROSSLAND, B. C.
Scale: 80 Feet-1 Inch.
J. H. Mackenzie
General Manager.
C. E. Simpson
Surveyor
NOTE-Stoping during the Twelve Months ending June 30th 1902 can be distinguished by the Heavy Black Contour Lines
EXECUTIVE ORE SHOOT
SOUTH VEIN
MULLIGAN
SHOOT

SMELTER EXPENDITURE.

The "labour trouble" which has been referred to before in this report, besides retarding the operations of the smelter very materially, did much, both directly and indirectly, to increase the working costs of the year under review.

The total working expense for the year, segregated as follows, amounted to		$1,194,567 67
Smelting ores	$1,117,668 62	
Matte charges	76,899 05	
The total expenditure on Capital Account, made up as follows, was		122,281 60
New buildings	$35,948 74	
Bins, trestles, and roast yard	1,055 65	
Water and fire protection system	14,240 89	
Machinery	43,786 54	
Tramways and equipment	17,722 63	
Sewage system, etc.	4,527 15	
Purchase of 95 acres of land	5,000 00	

GENERAL REMARKS.

The matte shipped during the year was 6,779,067 tons of a nett value of $2,532,302.67, equal to $373.55 per ton. The ores smelted amounted to 265,761.078 tons, of which 56,073.695 tons were purchased. No profit accrues to your Company as a result of the treatment of the latter, owing to the fact that they were almost invariably bought on a falling market, and usually on a metallic basis of settlement which left a scant margin in favor of the smelter. It is merely necessary to state by way of illustration that your Company's contract with the Le Roi No. 2, Limited, and Rossland Great Western Mines, Limited, provides for the purchase of their ores on a basis of 98 per cent. of the copper extraction, while the actual recovery is much less; and virtually immediate payment at market quotations, while your Company's settlement with the refiners, fully 100 days later, has usually been on a lower basis of value.

The Company's holdings in the name of the Northport Smelting and Refining Company, Limited, besides the smelter and the ground upon which it is situated, comprise a half interest in the Northport water system; 95 acres of land adjoining the Northport town site, which cost $5,000; an undivided fourth interest in the platted Northport town site; a quarry which contains the limestone which is being drawn upon by the smelter; and a group of mining claims, known as the "La Fleur Comstock," situated near Republic, Ferry County, Washington. These claims were purchased three years ago for $49,500, but as they are practically undeveloped I can place no value upon them.

CONCLUSION.

This report would be incomplete unless some reference were made to the financial condition of the Company, which has recently been the subject of much comment, and exercised such a powerful influence over the price of its shares. While the Le Roi Mining Company, Limited, commenced the fiscal year of 1902 with an apparent surplus of assets in its favor, and made a profit of $233,290.00 during the nine months in which its mining operations were conducted, our books show that a deficit in assets existed at the close of the year. This paradoxical state of affairs is attributable to four causes, which are:—

1. Over-estimate of the value of the stock of metals on hand at the smelter on June 30th, 1901.
2. Failure to allow for losses of copper and silver in slag in estimating profits made prior to June 30th, 1901.
3. Fall in the price of metals which has taken place during the year ending June 30th, 1902.
4. Heavy expenditure made on capital account during the year.

As I have already submitted a lengthy report touching the over-estimate of the stock on hand and slag losses (see my letter dated May 6th, 1902, addressed to H. J. Hill, Esq., formerly Chairman of the Board), it is merely necessary to state that our assets sustained a reduction of approximately $300,000 under these two heads.

The fall in the price of metals has reduced the estimates which have been made concerning our profits very greatly, possibly to the extent of $80,000—the exact figures are impossible to ascertain. To make this statement clear, I should explain that by reason of the fact that the actual market value of our ores cannot be learned until they reach the hands of the refiners in the shape of matte it is impossible to estimate our profits over a given period with any degree of accuracy. For the purpose of the monthly reports which are transmitted to the London office, and for the settlements made between the mine and smelter, the practice has been followed of placing a value on the monthly outputs on the metallic basis prevailing during the month in which the ore is mined. This procedure, apparently the only one which could be pursued under the circumstances, operates satisfactorily when copper and silver prices remain comparatively steady; but when fluctuations, such as have taken place several times during the past year, occur, profits are metamorphosed into actual losses. According to the showing made by our ore books, the profit of $233,290 previously referred to has been made on the first-class ore mined and the second-class ore treated, basing our estimates in the manner indicated, when, as a matter of fact, the matte settlements, made about three months after the receipt of the ore at the smelter, at the market prices then prevailing were approximately $50,000 less. An additional sum of $30,000 may be said to have been lost on the sales of "Custom" ores owing to the fall in prices.

The capital expenditures on the Company's smelter shows that over $117,000 have been spent during the year in various ways. The installation of blast furnace No. 6, completion of the calcine furnace, &c., the purchase of the steam shovel, additional boilers and sampling mill machinery, &c., are responsible for nearly one-half of this sum, while the balance was expended in the purchase and installation of pumps, &c., used in connection with the water and fire protection system, buildings erected at the time of the strike for the accommodation of the employees, installation of a sewage system, &c., and in connection with the electrical machinery for the tramway. The money expended at the Mine on machinery and plant and surface improvements was comparatively small, amounting to less than $13,000. Half of the amount was spent in the construction of a flume and in making additional improvements in connection with our water and fire protection system, whilst the remainder of the sum was expended in the erection of or additions to buildings and in the purchase of additional machinery.

B. C. Exploring Syndicate.—The Directors have resolved to raise debentures to the extent of one-fourth of the issued capital of the Company. These debentures will be of the nominal value of £10 each, bearing interest at the rate of 6 per cent. per annum, with a bonus of 20 per cent. in shares of the Syndicate on redemption.

LE ROI II.

The following is excerpted from the Directors Report, submitted on the 3rd ultimo.

The Directors herewith submit the audited accounts of the company for the year ending 30th September, 1902, showing a balance to the Credit of Profit and Loss Account of £44,986 19s. 8d., out of which an interim dividend of 5 per cent. has been paid.

The shareholders will see that the total output during the financial year was 63,261 tons, of a gross value of $1,068,915.78.

The heavy fall in the price of copper and silver during the last nine months of the financial year decreased by $121,182 what would otherwise have been the nett earnings of the Company had the price of the previous year been maintained.

Cost of mining amounted to $3,702 per ton.

The smelting charges to which the Company was bound for two years by an agreement made by Mr. MacDonald with the Northport Smelter, on the 16th of August, 1901, amounted approximately to $8 per ton.

The Directors took Counsel's opinion as to the possibility of nullifying this agreement on the ground that it was signed by Mr. McDonald for both sides, under a very limited Power of Attorney, but were advised that there were small chances of success.

The largest profit was shown in the month of April, after which there was a steady decrease in the value of the output and a corresponding decrease in profit.

On September 21st, the manager cabled recommending the reduction of the output to 3,500 tons per month, which, in view of the smelting position, the Board thoroughly approved of, expressing at the same time a hope that the grade of ore would be correspondingly increased.

During the months of September and October it would appear that the mine was actually being worked at a loss. As soon as the Board ascertained this they prohibited the output of any ore under $17, as it was evident that the mine was simply being denuded of ore which it was believed, under improved methods of treatment, can be made to yield a material profit.

According to Mr. McDonald's statement of high grade ore in sight, dated June 21st, and circulated among the shareholders, there should have been no difficulty in continuing the output of $17 ore.

On 28th October the manager recommended the cessation of shipments till better rates for treatment could be secured, to which the directors assented.

At the expiry of the agreement with Messrs. McDonald & Thompson, the Board handed over the management of the mine to Mr Alexander Hill, who himself installed his representative, Mr. Couldry, in office. In taking this step the Board feel that they have placed the mine under the most capable control procurable, and have also insured that information received by the Board will be in accordance with fact.

The new manager will not at present commit himself to any figures as to tonnage and values in sight in the mine, as it is impossible to estimate these with any degree of certainty where ore bodies are so irregular.

There is, however, beyond question a very large body of low grade ore which it is anticipated can be profitably worked by concentration, and interspersed with it an appreciable quantity of high grade ore. It will no doubt, be found best to ship ore above a certain grade direct to the smelter even when the concentration plant is in operation.

In connection with concentration a number of experiments have been recently made in London as to the suitability of the Elmore Oil process to Le Roi No. 2 low grade ores, and the result has been such as to warrent the directors in giving instructions for the erection of an experimental plant of two units, capable of dealing with 50 tons a day, in the neighborhood of the mine. Should this prove successful the intention is to increase the plant to such a capacity as can deal with the entire output of the mine.

The effect of the process, roughly speaking, is to concentrate the mineral contents of ores which are of two low a grade to show a profit on smelting charges.

Thus on six tons of crude ore producing say one ton of concentrates, the smelting charge (according to the present rates) would be $8 instead of $48. There is no doubt, however, that better terms than the present can be made for the smelting of concentrates, as these are a desirable acquisition to any smelter.

By the new process, too, the cost of mining will be considerably reduced, as the necessity for hand picking and sorting will no longer exist, all ore going through just as it comes out from the mine.

A certain amount of high grade ore is at present being shipped to the Northport Smelter, but till, by the new arrangement, the straighforward stoping of all ore (high and low grade) becomes practicable, much of the high grade ore in the mine would be too expensive to handle."

COMPANY NOTES.

Mond Nickel Company.—In their report to the shareholders for the year ended 30th April, 1902, submitted in July: "The Directors are pleased to be able to report the satisfactory progress of the Company's business, both in Canada and in England. Mining and smelting in Canada has been carried on continuously since last July, and the refining works at Clydach, are now in operation. The directors wish to draw attention to the item in the Balance Sheet, "Ore on Roast Yards and Products in Stock, £82,725 18s. 11d," the main portion of which is represented by high grade nickel and copper matte in stock and in transit, which has been produced at our smelting works. The whole of this stock has been valued at cost price (including general expenses from the incorporation of the Company to 30th April, 1902) which is much below its actual value. None of this matte, having up to the date of the balance sheet, been converted at the refining works into its ultimate products, viz., copper sulphate and refined nickel. The directors have perferred not to open a Profit and Loss Account."

Anglo-Klondyke Mining Co.—The following is extracted from the Directors report submitted on the 17th December last: From the amount of available net profit, viz., £28,467 17s. 2d., the directors recommend the declaration of a dividend of 20 per cent. on the ordinary shares. This will absorb £24,659 12s., leaving a balance to be carried forward of £3,808 5s. 2d.

Mikado Gold Mining Co.—The last issued report of the Directors (submitted in London on 11th November last) shows a debit balance of £5,052 4s. 6d., nearly the whole of which represents allowances made for depreciation on "mine development account," and ore exhausted during the year. The position of the Company at 30th September was roughly:—

Amount required to meet liabilities in Canada to 30th September, 1902, and to provide working expenses to end of March, 1903, according to manager's estimate, say	£5,400
Total liabilities in London	1,650
	£7,050
Less calls collectable, say	£3,320
Showing a deficit of, say	£3,730

Canadian Smelting Works.—The ore tonnage for 1902 at the Trail Smelting Plant was as follows:

45,000 tons in the copper furnaces.
30,000 tons in the lead furnaces.
75,000 tons ore smelted.

There was produced from the above 1,050 tons of copper matte containing gold, 18,219 ozs; silver, 94,309 ozs; copper, 1,101,837 lbs. The lead bullion produced was about 4,200 tons containing:

Gold ..... 12,431 ozs.
Silver ..... 1,123,779 ozs.
Lead ..... 8,314,313 lbs.

There were 870 tons of refined lead produced at the Trail refinery, all of which were sold on the Canadian market.

Lillooet Fraser River and Cariboo Gold Fields.—The liquidators have issued a report to the shareholders under date of 10th January, from which we quote: "As will be seen from the accounts the ascertained liabilities of the Company amounted to £450 4s 1d., but it is possible that claims for outstanding taxes on the various properties in British Columbia will come in later. These may amount altogether to £100 to £150. After providing for these liabilities and the expenses of the liquidators in London and in British Columbia the whole of the assets of the Company will be available for distribution among the shareholders."

Morrison Mines.—At the annual general meeting held on 20th December, the following were elected directors for the ensuing year: John Hunner, President; F. R. Fisk, Vice-President; A. F. Oliver, Secretary-Treasurer; F. C. Loring and E. K. Erwin. The following is taken from the balance sheet: Capital, $15,000; assessment account, $51,928.04; boarding house, $993.11; ore account, $75.43; bond account, $5,000; George P. Crane, $191.30. On the other side the entries show: Assessment Record, $2.37; interest, $359.05; property account, $151,238.02; development, $26,400.31; supplies, $3,837.60; general expenses, $5,163.34; office expenses, $3,899.90; fuel, $1,617.00; powder, $3,111.83; assaying, $341.50; hauling, $432.27; permanent improvements, $4,399.73; legal, $858.90; freight, $76.22; Little Buffalo Claim, $6,000; office furniture and fixtures, $299.50; cash on hand, $150.34.

The British Columbia Copper Co., Ltd.—The Directors report for 1903, states: "In transmitting to you the report of the auditor showing the financial condition of this Company at the close of business in November 30th last, the Directors have to advise that you have a mine developed by over a mile of workings and to a depth of only about 500 feet, which, in the opinion of the Company's engineer, discloses over 3,000,000 tons of ore. This ore carries copper, gold and silver, the two latter being in nearly sufficient values to pay the cost of smelting. It can be cheaply mined and delivered to the Company's smelting plant and can there be made into a copper matte as cheap or cheaper than at any other reduction works in the country.

The Company's smelting plant consists of two blast furnaces 42 x 150 with adequate power and equipment, with a daily capacity of about 800 tons. At the mine there are the necessary hoisting machinery, air compressors and ore crushers.

We need immediately a convertor plant, in order that our shipments shall be a 98 per cent. blister copper instead of a 45 per cent. matte. The savings to be affected by the installation of this plant will alone make a good dividend on the Company's capital.

In the judgment of the Board, the blast furnace capacity should be increased as soon as possible to 2,000 tons per day.

We have reason to suppose that we shall have additional railway facilities during the coming summer by the completion of the Great Northern Railway into our property.

The Board has deemed it wise in the present condition of the Company's affairs to charge off as against mining property, mine and smelter buildings, etc., all the profits of the Company, and you will note that the same has been done on the accompanying statement."

Colonial Copper Co.—Mr. J. A. Hanway, President in his report to the shareholders under date of 3rd ulto., says: "I might say, before entering into the details, that the work has been energetically pushed, and much has been accomplished during the past year, which has met with the universal approval of the directors and all the shareholders who have inspected the mines.

This work has been confined to three of the leads or lodes on the property, viz., No. 1, No. 2 (or Hanway Lode) and No. 3 (or Bennett Brook), and that during the year a large amount of development work has been done. About 2,000 feet have been driven in the various tunnels, drifts and cross cuts. Work has been deferred on the other leads or veins until we have the three above mentioned fully developed, when it is the intention of the management to start work on the latter. Owing to the failure of the manufacturers to deliver some of the machinery ordered for the concentrating plant, we have been unable to get the mill in operation, but it will be only a short time until it is in operation, and the policy of the Company is to steadily increase the treating capacity as the development of the mines progress, so as to have annually an increased output for many years to come. No. 1 Shaft, in depth 371 feet with over 1,000 feet of tunnel and drifts from same. Now sinking on the vein, rock very fine. No. 2 or Hanway Lode. Slope going south from surface 326 feet. Slope going north from surface on the vein 300 feet. More than 800 feet of tunnels and drifts in addition. No. 3 or Bennett Brook. Vertical shaft, in depth 180 feet with tunnels and drifts of over 300 feet.

During the past year a new power plant has been erected at No. 2 or Hanway Lode, well equipped with machinery, Rand Duplex Air Compressor, three large hoisting engines, boilers, etc. Also additional machinery at Nos. 1 and 3.

All machinery has been set and work done in a thorough and substantial manner, and arranged with the view of handling the ore at the minimum cost.

Nearly all the machinery has been installed in the ore crushing and concentrating plant.

The management is very desirous of getting the mill in operation and to produce copper at the earliest possible date, and no effort will be spared to this end.

During the past year a railroad has been built over 1¼ miles and is equipped with alocomotive and ore cars for conveying the ore from the mines to the mill. The road is 36 gauge, 40 lb. rail and well built.

A number of additional houses have been erected for the miners. Another boarding house erected at No. 2, an assay office with drafting room above, a large addition to the Lodge at the Cove, and other necessary buildings.

Considering that it has only been about 2½ years since work has started at Cape D'Or, we fail to see how even the most impatient can criticise the progress.

One must visit the mines to fully realize what a gigantic undertaking it is and the apparent great future the Company has.

The same effort and economic policy will be pursued, and by the time another annual meeting is held, we trust our treasurer will produce a statement of receipts from the product.

The financial condition of the Company is in the same good, sound and safe state as at the time of our last annual meeting. No debts have been contracted other than current accounts."

PROVINCE of QUEBEC

The attention of Miners and Capitalists in the United States and in Europe is invited to the

GREAT MINERAL TERRITORY

Open for investment in the Province of Quebec.

Gold, Silver, Copper, Iron, Asbestos, Mica, Plumbago, Phosphate, Chromic Iron, Galena, Etc.

ORNAMENTAL AND STRUCTURAL MATERIALS IN ABUNDANT VARIETY.

The Mining Law gives absolute security to Title, and has been specially framed for the encouragement of Mining.

Mining concessions are divided into three classes :—

1. In unsurveyed territory (*a*) the first class contains 400 acres, (*b*) the second, 200 acres, and (*c*) the third, 100 acres.

2. In surveyed townships the three classes respectively comprise one, two and four lots.

All lands supposed to contain mines or ores belonging to the Crown may be acquired from the Commissioner of Colonization and Mines (*a*) as a mining concession by purchase, or (*b*) be occupied and worked under a mining license.

No sale of mining concessions containing more than 400 acres in superficies can be made by the Commissioner to the same person. The Governor-in-Council may, however, grant a larger extent of territory up to 1,000 acres under special circumstances.

The rates charged and to be paid in full at the time of the purchase are $5 and $10 per acre for mining lands containing the superior metals* ; the first named price being for lands situated more than 12 miles aud the last named for lands situated less than 12 miles from the railway.

If containing the inferior metal, $2 and $4 according to distance from railway.

Unless stipulated to the contrary in the letters patent in concessions for the mining of superior metals, the purchaser has the right to mine for all metals found therein ; in concessions for the mlning of the inferior metals, those only may be mined for.

*The superior metals include the ores of gold, silver, lead, copper, nickel, graphite, asbestos, mica, and phosphate of lime. The words inferior metals include all other minerals and ores.

Mining lands are sold on the express condition that the purchaser shall commence *bona fide* to mine within two years from the date of purchase, and shall not spend less than $500 if mining for the superior metals ; and not less than $200 if for inferior metals. In default, cancellation of sale of mining lands.

(*b*) Licenses may be obtained from the Commissioner on the following terms :—Application for an exploration and prospecting license, if the mine is on private land, $2 for every 100 acres or fraction of 100 ; if the mine is on Crown lands (1) in unsurveyed territory, $5 for every 100 acres, and (2) in unsurveyed territory, $5 for each square mile, the license to be valid for three months and renewable. The holder of such license may afterwards purchase the mine, paying the prices mentioned.

Licenses for mining are of two kinds : Private lands licenses where the mining rights belong to the Crown, and public lands licenses. These licenses are granted on payment of a fee of $5 and an annual rental of $1 per acre. Each license is granted for 200 acres or less, but not for more ; is valid for one year, and is renewable on the same terms as those on which it was originally granted. The Governor-in-Council may at any time require the payment of the royalty in lieu of fees for a mining license and the annual rental—such royalties, unless otherwise determined by letters patent or other title from the Crown, being fixed at a rate not to exceed three per cent. of the value at th mine of the mineral extracted after deducting the cost of mining it.

The fullest information will be cheerfully given on application to

THE MINISTER OF LANDS, MINES AND FISHERIES,

PARLIAMENT BUILDINGS, QUEBEC, P. Q.

PROVINCE OF NOVA SCOTIA.

Leases for Mines of Gold, Silver, Coal, Iron, Copper, Lead, Tin

—AND—

PRECIOUS STONES.

TITLES GIVEN DIRECT FROM THE CROWN, ROYALTIES AND RENTALS MODERATE.

GOLD AND SILVER.

Under the provisions of Chap. 1. Acts of 1892, of Mines and Minerals, Licenses are issued for prospecting Gold and Silver for a term of twelve months. Mines of Gold and Silver are laid off in areas of 150 by 250 feet, any number of which up to one hundred can be included in one License, provided that the length of the block does not exceed twice its width. The cost is 50 cents per area. Leases of any number of areas are granted for a term of 40 years at $2.00 per area. These leases are forfeitable if not worked, but advantage can be taken of a recent Act by which on payment of 50 cents anuually for each area contained in the lease it becomes non forfeitable if the labor be not performed.

Licenses are issued to owners of quartz crushing mills who are required to pay Royalty on all the Gold they extract at the rate of two per cent. on smelted Gold valued at $19 an ounce, and on smelted Gold valued at $18 an ounce.

Applications for Licenses or Leases are receivable at the office of the Commissioner of Public Works and Mines each week day from 10 a.m. to 4 p.m., except Saturday, when the hours are from 10 to 1. Licenses are issued in the order of application according to priority. If a person discovers Gold in any part of the Province, he may stake out the boundaries of the areas he desires to obtain, and this gives him one week and twenty-four hours for every 15 miles from Halifax in which to make application at the Department for his ground.

MINES OTHER THAN GOLD AND SILVER.

Licenses to search for eighteen months are issued, at a cost of thirty dollars, for minerals other than Gold and Silver, out of which areas can be selected for mining under lease. These leases are for four renewable terms of twenty years each. The cost for the first year is fifty dollars, and an annual rental of thirty dollars secures each lease from liability to forfeiture for non-working.

All rentals are refunded if afterwards the areas are worked and pay royalties. All titles, transfers, etc., of minerals are registered by the Mines Department for a nominal fee, and provision is made for lessees and licensees whereby they can acquired promptly either by arrangement with the owner or by arbitration all land required for their mining works.

The Government as a security for the payment of royalties, makes the royalties first lien on the plant and fixtures of the mine.

The unusually generous conditions under which the Government of Nova Scotia grants its minerals have introduced many outside capitalists, who have always stated that the Mining laws of the Province were the best they had had experience of.

The royalties on the remaining minerals are: Copper, four cents on every unit; Lead, two cents upon every unit; Iron, five cents on every ton; Tin and Precious Stones, five per cent.; Coal, 10 cents on every ton sold.

The Gold district of the Province extends along its entire Atlantic coast, and varies in width from 10 to 40 miles, and embraces an area of over three thousand miles, and is traversed by good roads and accessible at all points by water. Coal is known in the Counties of Cumberland, Colchester, Pictou and Antigonish, and at numerous points in the Island of Cape Breton. The ores of Iron, Copper, etc, are met at numerous points, and are being rapidly secured by miners and investors.

Copies of the Mining Law and any information can be had on application to

THE HON. A. DRYSDALE,
Commissioner Public Works and Mines,
HALIFAX, NOVA SCOTIA.

DOMINION OF CANADA

SYNOPSIS OF REGULATIONS

For Disposal of Minerals on Dominion Lands in Manitoba, the North-West Territories, and the Yukon Territory.

COAL.

Coal lands may be purchased at $10.00 per acre for soft coal, and $20.00 for anthracite. Not more than 320 acres can be acquired by one individual or company. Royalty at such rate as may from time to time be specified by Order-in-Council shall be collected on the gross output.

QUARTZ.

Persons of eighteen years and over and joint stock companies holding Free Miner's certificates may obtain entry for a mining location.

A Free Miner's Certificate is granted for one or more years, not exceeding five, upon payment in advance of $10.00 per annum for an individual, and from $50.00 to $100.00 per annum for a company, according to capital.

A Free Miner having discovered mineral in place may locate a claim 1500 x 1500 feet by marking out the same with two legal posts, bearing location notices, one at each end of the line of the lode or vein.

The claim shall be recorded within fifteen days if located within ten miles of a Mining Recorder's Office, one additional day allowed for every additional ten miles or fraction. The fee for recording a claim is $5.00.

At least $100.00 must be expended on the claim each year or paid to the Mining Recorder in lieu thereof. When $500.00 has been expended or paid the locator may, upon having a survey made and upon complying with other requirements, purchase the land at $1.00 per acre.

Permission may be granted by the Minister of the Interior to locate claims containing iron and mica, also copper in the Yukon Territory, of an area not exceeding 160 acres.

The patent for a mining location shall provide for the payment of royalty on the sales not exceeding five per cent.

PLACER MINING, MANITOBA AND THE N.W.T., EXCEPTING THE YUKON TERRITORY.

Placer mining claims generally are 100 feet square; entry fee, $5.00, renewable yearly. On the North Saskatchewan River claims are either bar or bench, the former being 100 feet long and extending between high and low water mark. The latter includes bar diggings, but extends back to the base of the hill or bank, but not exceeding 1,000 feet. Where steam power is used, claims 200 feet wide may be obtained.

DREDGING IN THE RIVERS OF MANITOBA AND THE N.W.T., EXCEPTING THE YUKON TERRITORY.

A Free Miner may obtain only two leases of five miles each for a term of twenty years, renewable in the discretion of the Minister of the Interior.

The lessee's right is confined to the submerged bed or bars of the river below low water mark, and subject to the rights of all persons who have, or who may receive entries for bar diggings or bench claims, except on the Saskatchewan River, where the lessee may dredge to high water mark on each alternate leasehold.

The lessee shall have a dredge in operation within one season from the date of the lease for each five miles, but where a person or company has obtained more than one lease one dredge for each fifteen miles or fraction is sufficient. Rental $10.00 per annum for each mile of river leased. Royalty at the rate of two and a half per cent., collected on the output after it exceeds $10,000.00.

DREDGING IN THE YUKON TERRITORY.

Six leases of five miles each may be granted to a free miner for a term of twenty years, also renewable.

The lessee's right is confined to the submerged bed or bars in the rivers below low water mark, that boundary to be fixed by its position on the 1st day of August in the year of the date of the lease.

The lessee shall have one dredge in operation within two years from the date of the lease, and one dredge for each five miles within six years from such date. Rental, $100.00 per mile for first year, and $10.00 per mile for each subsequent year. Royalty ten per cent on the output in excess of $15,000.00.

PLACER MINING IN THE YUKON TERRITORY.

Creek, Gulch, River, and Hill claims shall not exceed 250 feet in length, measured on the base line or general direction of the creek or gulch, the width being from 1,000 to 2,000 feet. All other Placer claims shall be 250 feet square.

Claims are marked by two legal posts, one at each end bearing notices. Entry must be obtained within ten days if the claim is within ten miles of Mining Recorder's office. One extra day allowed for each additional ten miles or fraction.

The person or company staking a claim must hold a Free Miner's certificate.

The discoverer of a new mine is entitled to a claim 1,000 feet in length, and if the party consists of two, 1,500 feet altogether, on the output of which no royalty shall be charged, the rest of the party ordinary claims only.

Entry fee $15.00. Royalty at the rate of 2½ per cent. on the value of the gold shipped from the Territory to be paid to the Comptroller.

No Free Miner shall receive a grant of more than one mining claim on each separate river, creek, or gulch, but the same miner may hold any number of claims by purchase, and Free Miners may work their claims in partnership, by filing notice and paying fee of $2.00. A claim may be abandoned and another obtained on the same creek, gulch, or river, by giving notice, and paying a fee.

Work must be done on a claim each year to the value of at least $200.00, or in lieu of work payment may be made to the Mining Recorder each year for the first three years of $200.00, and after that $400.00 for each year.

A certificate that work has been done or fee paid must be obtained each year; if not, the claim shall be deemed to be abandoned, and open to occupation and entry by a Free Miner.

The boundaries of a claim may be defined absolutely by having a survey made, and publishing notices in the *Yukon Official Gazette*.

HYDRAULIC MINING, YUKON TERRITORY.

Locations suitable for hydraulic mining, having a frontage of from one to five miles, and a depth of one mile or more, may be leased for twenty years, provided the ground has been prospected by the applicant or his agent; is found to be unsuitable for placer mining; and does not include within its boundaries any mining claims already granted. A rental of $150.00 for each mile of frontage, at the rate of 2½ per cent. on the value of the gold shipped from the Territory. Operations must be commenced within one year from the date of the lease, and not less than $5,000.00 must be expended annually. The lease excludes all base metals, quartz, and coal, and provides for the withdrawal of unoperated land for agricultural or building purposes.

PETROLEUM.

All unappropriated Dominion Lands shall, after the first of July, 1901, be open to prospecting for petroleum. Should the prospector discover oil in paying quantities he may acquire 640 acres of available land, including and surrounding his discovery, at the rate of $1.00 an acre, subject to royalty at such rate as may be specified by Order in Council

JAMES A. SMART,

Deputy of the Minister of the Interior.

OTTAWA, 9th Dec., 1901.

CONTRACTORS TO H. M. GOVERNMENT

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TELEGRAMS—"Ropery Rutherglen." A B C, A I and Lieber's Codes used.

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