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SIXTEENTH YEAR OF PUBLICATION.

The Canadian Mining Review

Established 1882

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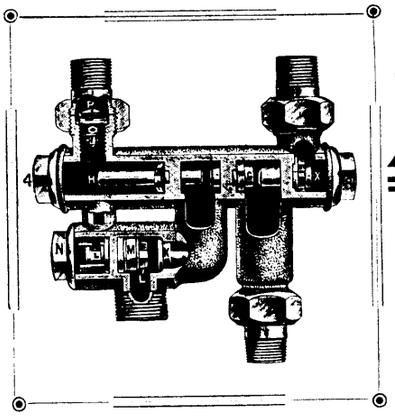

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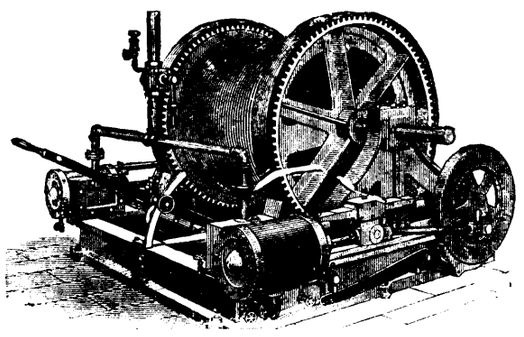

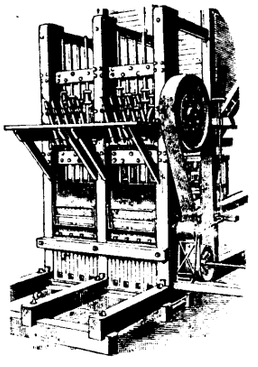

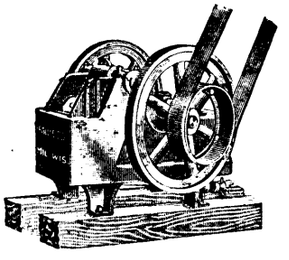

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PROVINCE OF BRITISH COLUMBIA.

Gold, Silver, Lead, Copper, Coal, Coke, Oil, Iron, Mercury, Platinum, Etc., Etc.

THE MINES OF BRITISH COLUMBIA HAVE PRODUCED OVER $100,000,000.

AMOUNT AND VALUE OF MATERIALS PRODUCED 1895 AND 1896.

	Customary Measures.	1895. Quantity.	1895. Value.	1896. Quantity.	1896. Value.
Gold, Placer	Oz.	24,084	$ 481,683	27,201	$ 544,026
" Quartz	Oz.	39,264	785,271	62,259	1,244,180
Silver	Oz.	1,496,522	977,229	3,135,343	2,100,689
Copper	Lbs.	952,840	47,642	3,818,556	190,926
Lead	Lbs.	16,475,464	532,255	24,199,977	721,384
Coal	Tons	939,654	2,818,962	846,235	2,327,145
Coke	Tons	452	2,260	615	3,075
Other materials			10,000		15,000
			$5,655,302		$7,146,425

Production for 1890, $2,608,608; for 1896, $7,146,425.

GOLD.

Gold-bearing lodes are now being prospected in many parts of the province, and at Rossland magnificent ore-chutes of very profitable gold-copper ore are being mined and smelted, the Le Roi having paid to date, $675,000 in dividends, with a large and increasing amount of ore in sight as the workings attain greater depth, while systematic development on other properties is meeting with excellent results, mining having just fairly begun in this camp. Little doubt can now be entertained that Rossland will become a heavy producer of gold, and that excellent properties now only await sufficient and abundant capital to become paying mines, to further aid in which the facilities for cheaper transportation and smelting are being now supplied. At NELSON and at FAIRVIEW, CAMP MCKINLEY, GREENWOOD, CENTRAL and other camps in the southern part of Yale, important work is being done on the quartz ledges there, several new mills being under erection.

Exploratory work is also in progress in EAST KOOTENAY and in LILLOOET, ALBERNI, and on the Gulf islands and along the coast line of the mainland, as well as in other parts of the province.

In CARIBOO, several large undertakings, involving a large amount of capital, are at work exploring both modern and ancient river channels, the Cariboo Hydraulic Mining Co., on the Quesnelle river, proving, on development, to have in a channel of the latter kind, a great gravel deposit of exceptional richness, while other parts of this district now offer every inducement to capital.

Into CASSIAR, OMENICA, and the great area to the north, as well as Cariboo, there now promises to be a great exodus of explorers, incited by rich diggings now being mined in the YUKON, as on the KLONDYKE, to the north, and river and creeks long reported to be gold-bearing will now be made accessible, and well tested.

SILVER-LEAD.

Despite the drop in the price of silver, the SLOCAN mines are being much more extensively worked, while the shipments of high grade ore are constantly increasing, the higher price of lead more than compensating for the lower silver values. The production for 1897 will much exceed that of 1896, as such mines as the "Slocan Star," "Payne," "Ruth," "Whitewater" and other mines increase their output.

At NELSON, the "Silver King" or Hall mines is shipping constantly a large amount of silver-copper ore, and the LARDEAU, TROUT TAKE, ILLECILLEWAET districts, on further exploration, promise to become rich districts. In EAST KOOTENAY large bodies of silver-lead ore will be mined on completion of the railroads now under construction.

COPPER.

Copper is being produced to a limited extent at ROSSLAND and NELSON, but the large deposits of at present low-grade ore in the BOUNDARY CREEK district will be fully tested when the railroad, now almost assured, is constructde. Prospecting is being done at KAMLOOPS, along the west coast of the mainland and of Vancouver island, as well as at many other points, and TEXADA is producing high grade bornite ore.

COAL AND COKE.

The large collieries on VANCOUVER ISLAND are producing about a million tons of coal annually, and at COMOX an excellent coke is now being produced, much of which is shipped to the inland smelters. The great deposits of coking coal in East Kootenay, at the CROW'S NEST PASS, are now being opened, as the C P.R. is now being built to the Columbia river to supply the great mining regions with cheap coal and coke.

SMELTERS AND RAILROADS.

The smelting industry is now beginning to assume large proportions, as preparations are being made to treat the ores of this province within her own borders, a most important factor in the increasing prosperity of this country, entailing as it does, and will, the employment of much capital and many men. The extension of the railroad systems to different parts is now in progress. and the next few years will see many parts in which the prospects for good mining are excellent, made easy of access, while ores can be shipped with facility to the smelting centres, where the assembling of the various interfluxing ores will make possible the treatment of all British Columbia ores at home.

CAPITAL.

Capital can now find here excellent and many opportunities for investment, if proper business care and the experience of qualified men are utilized, as the values placed on mines and undeveloped properties have reached a reasonable basis.

MINERAL LANDS.

Mineral lands are open to location to any person over eighteen years of age, who has obtained a free miner's certificate, and perfect titles to lode claims can be easily secured after $500 worth of work has been done per claim. A great extent of territory has yet to be prospected.

YUKON GOLD FIELDS.

As the KLONDYKE and other gold fields in the Yukon in British territory is reached mostly via British Columbia, all SUPPLIES and OUT-FITS obtained at VICTORIA, VANCOUVER, ASHCROFT, KAMLOOPS, etc., can be taken in FREE OF DUTY, which otherwise WILL HAVE TO BE PAID if not purchased in CANADA.

For information, Reports, Bulletins, etc., address

W. A. CARLYLE, M.E.,
Provincial Bureau of Mines,
VICTORIA, B.C.

The HON. JAMES BAKER,
Minister of Mines,
VICTORIA, B.C.

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 annually 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 acquire 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. C. E. CHURCH,

Commissioner Public Works and Mines,

HALIFAX, NOVA SCOTIA.

16th YEAR OF PUBLICATION.

The Canadian Mining Review

Established 1882

Official Organ of the Mining Society of Nova Scotia; The General Mining Association of the Province of Quebec; The Asbestos Club; and the Representative Exponent of the Mineral Industries of Canada.

B. T. A. BELL, Editor and Proprietor. Published Monthly. OFFICES {Slater Building, Ottawa; Metropole Building, Halifax; Windsor Hotel, Montreal.

VOL. XVII., No. 3. MARCH, 1898. VOL. XVII., No. 3.

Another English "Yellow-Legger."

It has been our unpleasant task of late to refer in these columns to the eagerness with which so-called English experts, after very limited sojourn, rush into print to air their knowledge of Canada and her gold fields. The list of such "chappies" is not yet exhausted, to judge from the latest example that has come to our notice.

The Journal of the Royal Colonial Institute for February contains a paper on the "Gold Fields of Ontario and British Columbia" by a Mr. E. P. Rathbone, who at one time, it is stated, was connected with the inspection of mines in the Transvaal, and who arrived in the Ontario fields during the latter part of May, 1897, whence, after five or six weeks sojourn he went west to British Columbia. In the latter province he visited one or two vein mining districts and left about the 1st of October on his return trip to England, having had less than four months' actual experience of the two fields referred to. This does not, however, deter Mr. Rathbone from pronouncing an authoritative opinion, and a less time usually suffices for the average South Africander to "know all about it."

By way of preface we may say that we have rarely read a paper which contains less original and valuable information than this one of Mr. Rathbone's.

Beginning with the statement that this paper will deal with Ontario and British Columbia, in a very few lines Mr. Rathbone refers to the whole "Dominion of Canada," and announces that payable gold vein mining "in the Dominion" has only existed since 1893. His date is only a matter of thirty odd years out—a small error, truly. Prior to 1893 Canada had produced over $12,000,000 nearly £2,500,000 stg.—exclusively from vein mining. And this leads directly to another error Mr. Rathbone has made when he considered "that the Dominion Government should have a separate office to collect all the mineral statistics from the various provinces in one statement." For many years now the Government has maintained a section of the Geological Survey Department entirely devoted to "Mineral Statistics and Mines" in which can be found admirably tabulated and edited, the mineral production of Canada for more than ten years past.

It is a characteristic of this species of the genus expert that he will write upon subjects upon which he has not taken even ordinary pains to become informed.

We advise Mr. Rathbone to at once obtain access to the library of the Royal Colonial Institute, and there consult the annual reports of the "Geological Survey of Canada, Section of Mineral Statistics and Mines" in which he will find such information as will considerably enlarge his knowledge of Canada, and her method of collecting statistics.

Mr. Rathbone's opinion that the Ontario Bureau of Mines is conducted in such a manner as to "leave much to be desired" we recommend to Director Blue's attention; the REVIEW has already expressed a similar opinion. We are glad to be able to agree with Mr. Rathbone in his remarks upon exploration work particularly as applied to the province of Ontario. It is nonsense indeed to expect purchasers to pay a cash price for claims which have not been developed sufficiently to show if they possess value; but an error is committed in stating that the largest gold producing mine in Ontario, (the Sultana) does not make any public returns of its gold production. It does not make returns to the proper official, but that official (perhaps wisely) does not, in making up his returns for the whole Province, specify the product of this or any other one mine. The statement that the mining laws of the province of Ontario "are greatly inferior" to those of British Columbia was disputed in the discussion which followed the paper, and is contrary to the opinion of Dr. R. W. Raymond expressed in these columns; an authority, we fancy, infinitely better informed upon the subject of mining laws than is Mr. Rathbone.

The extent and value of Mr. Rathbone's investigation in British Columbia we leave for our western friends to judge, when he states that the "gold associated with the matrix" of the Rossland deposits is "disseminated in a remarkably even manner throughout." If there has been any one thing which has been *thoroughly demonstrated* in regard to the Rossland deposits, it is that the gold in the iron sulphides is very unevenly distributed and that the only method by which one can successfully follow or distinguish a pay streak from poor rock is by unremittingly assaying every foot of ground passed through. This statement needs no proof to anyone familiar with Rossland mines.

Mr. Rathbone's intimate familiarity with the conditions of mining in the great republic, to the south of us is well shown in his remarks that "the most important metalliferous mining work that of late years has been carried out in the United States, has been in the States of Washington, Idaho, Montana, Dakota and Michigan," as this comes immediately after the reference to the continuous chains of mountains extending from the Arctic to the Antartic regions, it does not take much of a student of geography to wonder where in this range of mountains Michigan and Dakota come in, nor require a very aged mining student to ask the question, what of the importance of the "metalliferous mining" carried on of recent years in Cripple Creek and other parts of Colorado? Mr. Rathbone, we believe, is the first man pretending to scientific attainments who has traced a "progressive" mineral relationship from the copper and iron deposits of the State of Michigan, to the auriferous quartz deposits of the Huronian, in Ontario.

The Hon. Dr. Borden, M. P., our Minister of Militia, who was present called Mr. Rathbone to account in the discussion of the paper,

for omitting any allusion to Nova Scotia's gold fields, to which Mr. Rathbone offered the disclaimer that he had never been there, he only spoke of what he *knew*. As Mr. Rathbone, by actual count, has some seventeen sentences in thirteen small pages in which "Canada" or the "Dominion of Canada" is used, we are afraid his disclaimer is not entitled to much credence; he has spoken of many things of which he "knew" nothing.

"The risk of mismanagement" of mining properties according to Mr. Rathbone are greatly minimised because the Canadian fields are within two to three weeks' journey from *London*. When will the British public learn that so far as the North American continent is concerned the "risks of mismanagement" are always at a *maximum* when properties are managed "from London" and by English engineers? The short history of failures in British Columbia shows this clearly—the successes that have been made there have emphatically *not* been those handled by Englishmen sent out "from London." This point has been emphasised over and over again by Mr. Thomas Tonge in his contributions to the London *Mining Journal* and other technical papers. The wisest step to our mind that any prominent English company operating in Canada has taken has been made by the British America Corporation in appointing as its chief engineer Mr. W. A. Carlyle—a Canadian, educated in Canada, who has practiced not only in Canada but also in the United States. Familiar with the country, the people and the local conditions, Mr. Carlyle's advice will be more valuable to this company than that of any man "from London." Good English engineers there are, and also bad; so far Canada has had a surfeit of the latter.

CORRESPONDENCE.

Lead Smelting, Refining and Manufacturing in Canada.

One of the features of the recent meetings of the Federated Canadian Mining Institute was the unanimous adoption of a resolution to petition the Dominion Government to place an efficient duty on lead.

It will be readily conceded that it would be greatly beneficial to all classes and interests should the ores mined in British Columbia and other parts of the country be smelted, refined and manufactured in Canada. Some will take the stand that should it be possible to bring into existence such a far reaching industry, the people at large can stand the comparatively insignificant tax that prohibitory duties often impose on the country at large; others may argue that an industry to be truly beneficial should stand on its own merits without any support. However this may be, in this particular case after looking at the question on all sides, it will be found that no single individual in Canada should suffer from prohibitory duty on lead, unless perhaps a very few brokers who deal in this metal as imported from Mexico and England. It will occur that a high price will be the consequence of such an action, but this is not borne out by fact. The Report of the Department of Trade and Commerce for 1897, shows the consumption of lead and lead products in Canada as follows:—

(1)	White and Red Lead, Orange Mineral (estimated).	4,293	tons.
2	Lead Nitrate and Acitate	90	"
3	Lead Old, Scrap, Pig	3,264	"
4	Lead Blocks, Bars and Sheets	526	"
5	Lead Pipe	59	"
6	Lead Shot	15	"
(7)	Other mannfactures, N. E. S. (estimated)	822	"
8	Litharge	601	
	Total	9,670	"

(1) The total consumption of White and Red Lead, Orange Mineral and Zinc White, shown in the Report of the Department of Trade and Commerce for 1897, was 5,210 tons; no absolute data being obtainable to know what proportion of this amount was the product of Lead and what the product of Zinc. The percentage of Zinc White to White Lead consumed in the U. S. in 1896 was 17.6 per cent.; thus I have figured from this basis.

(2) In the Report of the Department of Trade and Commerce for 1897, no quantity except value in dollars is shown opposite "Other Manufactures N. E. S." therefore I have made a proportion between this value and the value opposite "Old, Scrap and Pig Lead" to get at a quantity.

So we can safely calculate the annual consumption of lead and its products in Canada as an equivalent to less than 10,000 tons. Now the output of lead from British Columbia during 1897 reported by Dr. G. M. Dawson, Director of the Geological Survey of Canada, shows the the lead production to be 39,018,219 lbs. We submit to the commercial intelligence of all men, with a supply so far exceeding the the demand, is it likely that the price of lead to the consumer is liable to rise materially from its present level? It may be shown that the price of lead in the U. S. went up when the present dnty was imposed, but it is easily understood when explained that the U S. does not produce sufficient lead within her borders to supply her demand, whereas, it is shown Canada does. It is not very likely that the consumption of lead in Canada will rapidly increase, whereas with such a duty as is proposed, the production in Canada will be greatly increased, as lead mines could be operated in Ontario; the Crows Nest Pass Railway will open up new fields; and low grade lead-silver Mines on Kootenay Lake and vicinity would be worked where they are now idle.

It is a fact that the demand from the U. S. Smelters for these lead ores would increase as the supply (for U. S. Smelters) from British Columbia became smaller; hence the miner would have the benefit of better pay for his ore.

It has been asked would not a direct subsidy be preferable to an import duty on lead for the purpose of establishing smelting and refining within Canada. It is only necessary to investigate the market to find that Canada is at present giving to the foreign seller of lead the full benefit of practically the New York market for that metal, getting a comparatively paltry amount of income in the form of a low duty. For instance, take Mexican lead, without the Canadian market, they would receive $20.00 to $40.00 per ton less for their lead—thus it is shown Canadian consumers are enriching the foreign lead producer and gaining nothing, whereas with a large surplus supply, Canadian lead miners would receive this benefit and the consumer would at most be none the worse off than at present.

The reciprocity idea with the U. S. has been brought forward as a more potent help to the lead producer; that is, it is suggested that overtures should be made to the U. S. Government to get them to ease up their tariff on lead into the U.S. as for instance, by taking the differential off pig lead to make the duty equal to lead in ore. The fallacy of this argument is shown at a glance at the following:—

Assuming the price received for lead in Montreal equal to New York or $3.50 per lb., $70.00 per ton, the miner would be charged with about $20.00 for freight and marketing his lead in Eastern Canada. Now should the differential be taken off and the miner only pay 1½c. per lb. duty, and and the lead would still have to be charged with freight and marketing to Eastern U. S. at about the same figure as in Canada or $20.00, hence the miner would receive marketing his lead in Canada $70.00 less $20.00 equal to $50.00 per net ton. In the United States he would receive $70.00 less (1½c. per lb. duty) $30.00 and $20.00 freight and marketing per ton equal to $20.00 net per ton

It is shown at present that a mine producing a 60 per cent. lead ore pays $22 00 freight and treatment 1½c. per lb. duty on 1,200 lbs. lead or $18.00; chargeabe against his ore $40.00, besides his expenses of mining, &c. He receives New York quotation, or say 3½c. per lb., or for 1,200 lbs. $42.00, so it is seen that for other expenses and profit, the mine must depend almost entirely upon values contained in other metals present, as silver or gold, thus a low grade mine where the ore requires concentrating to put in a marketable form at all, cannot be worked, but with the $30.00 per ton of lead going into the coffers of the United States Government, the case would present a different aspect for these

R. G. McCONNELL, B.A.,
(The new Provincial Mineralogist for the Province of British Columbia.)

miners. It must not be lost sight of that though the Canadian market would simply give the "leg to stand on" so to speak, but with this the surplus lead could be marketed in the Orient, where in China and Japan and Corea there is a market for several thousand tons per annum of lead and lead products. Lead ore from the Kootenay district has up to now most largely benefited American Railways. With smelters, refineries and factories in Canada, and to get the full benefit of the great Crows Nest Coal fields, a market must be made for the coal and coke—thus would this duty directly or indirectly benefit labouring classes and merchants all over Canada, enabling Canada to assert to the United States and the world at large her independent commercial policy in this respect at least, and becoming a large exporter of lead should be no small gratification to the hearts of loyal Canadians.

WM. BRADEN.

PILOT BAY, B.C., 28th March, 1898.

The Proposed Export Duty.

Replying to your enquiry of the 10th January: At first sight it may appear, as if placing an export duty on mineral shipments to the United States would have an injurious effect upon the expansion of the mining industry of British Columbia, that making the large market south of us more difficult of access to the miner would result in benefitting the B. C. smelters at his expense, and no doubt at first this might possibly be to some extent the case; but I think it would be found in practice that the local smelters would adhere to a low treatment rate to meet an almost certain reduction in railway rates on ores going out of the country, a reduction which would probably be equivalent to the export duty.

To my mind the question resolves itself very much into this: Is legislation to be carried out for the benefit of the few or for the many? If all the ores produced in the Kootenay District were smelted at home, it would mean millions of dollars being spent in the country which are now spent elsewhere, and of which not a dollar comes back to the country. It would mean an immense increase in the population of men earning high wages and spending money derived from Canadian ores in the country to which it belongs, and it would mean more than this, it would mean that mining would receive an immense impetus in the district, that as the demand of the home market increased for various ores, and for fluxes that would only be mined for local smelters, so would development work and prospecting increase also, and thus an export duty that would foster home smelting, is bound to aid the expansion of mining instead of retarding it.

HENRY CROASDAILE,
General Manager The Hall Mines, Limited.

Nelson, 20th March, 1898.

Commercial Progress as Influenced by the Development of the Pig Iron Industry.*

By JOHN BIRKENBINE, Philadelphia, Pa.

Omitting temporary disturbing causes of a national or international political character; comparisons of the present status of various nations, demonstrate that commercial prosperity is proportionate to the capacity of a country to produce what is required by its citizens or for other peoples; to it's financial ability to sustain these products, and to the facilities for distributing what it is able to supply.

This product may be of natural growth; as of cereals, fruits, lumber, etc.,—it may consist of minerals or of manufactured goods, and the nations which are best able to convert the natural product into useful forms, and to transport them cheaply to market, may claim pre-eminence.

A retrospect will bring to the notice of an observer numerous instances of local advancement in older districts which transformed crude into manufactured material, although the progress may have been limited owing to the area which could be reached by the transportation facilities applicable. As steam displaced animal, or wind powers, the market available was broadened, exchanges of commodities were made possible over larger territory, and the districts benefitted were increased in number and extent.

The same general conditions which influenced the advance of districts, counties, states or provinces, apply even more forcibly to nations; and we note the most marked improvement in those political divisions of the world which have developed their resources and supplied means for their distribution.

In the effort to secure such distribution many natural obstacles have been surmounted, and in the common parlance "distance has been annihilated" in many instances; so that in the state of transportation to-day, localities are only in part comparable by relative distances; the character of existing avenues of traffic, and the competition between rival routes being more nearly the gauge for competition.

Disclaiming any desire to minimize the important bearing upon national advancement which should be credited to other specialties, the iron industry may be given a leading position in securing commercial development. The term "iron industry" is intended to include all the steps from the mining of the ore to the production of the finished product in various forms of iron and steel. The winning of nature's crude materials from the earth, and (by the application of the mental and physical powers of man) the conversion of these into forms, which when properly applied add materially to our comforts, will improve any community and advance any nation.

This brief discussion will be confined practically to the production of pig iron, and the reliance of the more advanced stages of manufacture upon the crude metal, using the record made in the United States as illustrative.

Few articles which we manufacture have been so liberally discussed by political economists as pig-iron, and in legislation concerning custom duties, this product has assumed such a prominent position that we may infer that this particular industry is recognized as exerting a marked influence upon the progress of a country, and especially upon certain sections thereof. Facts sustain the inference, and probably no one industrial pursuit, except possibly coal mining, has done more to advance the United States than the production of pig iron, and by this product and subsequent manufactures, much assistance has been given to the development of the coal mining industry, which now contributes about 171,000,000 tons annually, or thirty per cent. of the world's out-put of coal.

In this connection attention may well be invited to the fact that much of the earlier advancement in iron production and manufacture was based upon the use of bog ores, which abound along the Atlantic sea-board, and which bear close relationship to the ores now smelted in the Province of Quebec in the production of metal of exceptional character.

Having a general knowledge of what has been done towards the establishment of a Canadian iron industry, and the efforts to encourage this by governmental or provincial assistance, some applications of the foregoing conclusions to the future of the Dominion may be expected at this time. The suggestions offered are not based upon detailed knowledge of local conditions superior to that possessed by many present, for I realize how much better equipped others are to discuss this subject locally. But it may be possible for one whose professional work has included numerious investigations of the

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adaptibility of various locations for the establishment of iron and steel industries, and whose examinations have embraced some of the ore deposits of the Dominion, to present new phases concerning pig iron production as exemplified in the records of progress in the United States, which may be applied to Canadian development.

If this paper should in a small way contribute to the advancement of a country whose borders co-incide with those of my native land, for a distance equal to one-sixth of the circumference of the globe; a country with which we have many ties; a country whose advancemen must be of assistance to my own. If any words of mine can add to the future progress of Canada, I shall be more than pleased.

Canada is well supplied with iron ores; many of them of excellent quality; some of them have withstood heavy cost of transportation and paid duty for consumption in blast furnaces in the United States, several hundred miles from where they were mined; others lie unattacked where nature placed them, waiting to be transformed into articles of usefulness by the hand of man.

If future investigation demonstrates that electro-metallurgy will supplant our present smelting processes, the numerous excellent water-powers for which Canada is famed, offer great possibilities for generating electricity cheaply and liberally, and if the utilization of the power of falling water does not extend to the primary process of reducing and smelting ores, these great reserves of power may prove serviceable in supplementary treatment of the metal produced.

Leaving this attractive field for the investigation of others, the subject of iron production may be considered, in the light of present knowledge, which requires that to obtain metallic iron upon a commercial scale as to quantity and cost, iron ore must be fed to blast furnaces, together with suitable fuel and flux, and these three materials must be accessible and of desirable character.

The problem which seems to retard the central Canadian industry is the bringing together of satisfactory fuels for smelting, and ores of desirable character close to the point of distribution or consumption.

In determining the availability of a district, or individual location for the production or manufacture of iron or steel, the requirements are:

"*A.*" The facilities of obtaining raw materials of satisfactory character, viz: —iron ores, fuel and flux, their cost and the character of metal which they will produce advantageously.

"*B.*" The market which can be conveniently reached, or which can be developed, and the character of product most in demand.

"*C.*" The transportation facilities; both existing and prospective, and rates obtainable on raw material and finished products.

"*D.*" The supply and cost of labor, and the conditions which may cheapen or enhance the wage rate.

"*E.*" The relation which the location bears to other established works which make similar products, and the competition which must be met from these.

"*F.*" The character of works which can be constructed and their cost.

"*G.*" The cost to produce pig iron and to manufacture iron and steel of the forms most in demand.

"*H.*" The probability of other locations where no iron is made but possessing equal or in some cases superior advantages, engaging in iron production.

"*I.*" In countries like the United States and Canada the trend of increasing population demands consideration.

The problem, therefore, is by no means a simple one, and in the light of recent concentration of numerous plants under one general management or control, the question of ample capital to build, equip and operate works, adds another factor.

In good practice the amount of ores required to produce a ton of pig iron will exceed the quantity of fuel and flux necessary to smelt them, and in a general way it would appear better polic, to convey the fuel and flux to the ore and smelt it. But transportation facilities, a market and ample cheap labor are necessary to insure success. Therefore, when ores, fuel and market are not all convenient, the question as to the location of a works will be influenced by relative conditions affecting each special feature.

Thus, in 1897 almost 12,500,000 tons of iron ore were shipped from the Lake Superior mines to furnaces, some of which are 1,500 miles distant, the average distance between the mines and furnaces using the ores being probably 800 miles. These ores have gone partly to meet the fuel, but the predominating attraction has been the market afforded for the distribution of the metal produced and the articles manufactured from it.

Chicago, Illinois, is dependent upon Michigan, Wisconsin and Minnesota, for iron ore, carried from 400 to 800 miles, and upon Pennsylvania and West Virginia for coke, transported 500 to 800 miles; the facilities for assembling these raw materials and distributing the finished products, added to a good home market, are responsible for the present advanced position of the Chicago district. Allegheny County, Pennsylvania, of which Pittsburg is the business centre, has the distiction of producing a larger amount of pig iron than any other district in the country. It has an excellent fuel supply close at hand, but the iron ores are brought an average distance of 900 miles from the Lake Superior region. The rail road facility for assembling raw material and taking away finished product; a near by market and intimate connection with the steel industry have combined to give Allegheny County pre-eminence.

The Birmingham district of Alabama is convenient to supplies of raw material, but distant from market demands, consequently its progress has been largely due to the possibility of producing non-Bessemer pig iron cheaply, to be manufactured elsewhere.

With the exception of a few charcoal blast furnaces in the New England States, the iron producing industry there is dormant, and although Eastern New York and New Jersey have abundant ores, the distance from a cheap fuel supply restricts their out-put of metal.

East Pennsylvania fares somewhat better because of a local development of the iron and steel industry, but is not advancing its production, nor is this to be expected unless the export trade demands greater activity on the part of its industries.

The bulk of later advances has been in the districts tributary to the great lakes, or which can be conveniently reached by the excellent ores of Lake Superior.

A brief summary of the development of the iron industry of the United States may be given in a statement of the rapidly increasing out-put of pig iron, this being the basis of the entire industry.

The statement is given by decades and for the years when the product exceed even millions of tons.

GROWTH OF THE PIG IRON INDUSTRY OF THE UNITED STATES.

Year.	*Gross Tons of Pig Iron Made.*	*Remarks Concerning Out-put.*
1810	53,908	
1830	165,000	Trebled in 20 years.
1840	286,903	Nearly doubled in 10 years.
1850	563,755	Doubled in 10 years.
1860	821,223	Increased nearly 50 p.c. in 10 years.
1864	1,014,282	First year when an out-put of 1,000,000 tons is recorded.
1870	1,665,179	Doubled in 10 years.
1872	2,548,713	First year when an out-put of 2,000,000 tons is recorded.

1880	3,835,191	Increased two and one-third times in 10 years, also first record of 3,000,000 tons.
1881	4,144,254	First record of production of 4,000,000 tons.
1886	5,683,329	First record of production of 5,000,000 tons.
1887	6,417,148	First record of 6,000,000 tons.
1889	7,603,642	First record of 7,000,000 tons.
1890	9,203,703	Increased two and one-third times in 10 years, and first record of 9,000,000 tons.
1897	9,652,680	Maximum annual product.

The past three months' rate of production has been at the rate of 12,000,000 tons.

These figures show that while the production of 1860 was about one-twelfth that of last year (1897 when 9,652,680 tons were made), it was five times greater than in 1830. Taking the census report for a half century, the data indicates that the *pig iron out-put of 1890 was over thirty-two times that of 1840.*

This indicates a rate of progress which has never been duplicated in any country in a similar interval of time, and it may never be again, for if the product of the blast furnaces of the United States increased in the same rate for fifty years subsequent, as it did for fifty years prior to 1890, this would reach the enormous total of 295,000,000 gross tons per annum, and require that in 1940 the country should produce in one year, two and one-half times the total out-put of all the United States furnaces for the fifty years, 1840-1890.

It may be of interest to note that until 1840 all of this iron was made with charcoal. The year 1855 was the first recorded in which the production of pig iron by the use of anthracite coal exceeded that made with charcoal, and in 1860 the relative proportions of iron made with the different fuels were practically twice as much charcoal pig iron as coke iron, and twice as much anthracite iron as charcoal iron.

In 1897 the quantities of pig iron made by the different fuels were:

Using coke and bituminous coal	8,464.692	gross tons
Using anthracite or anthracite and coke mixed	932,777	"
Using charcoal	255,211	"
Total	9,652,680	"

The great advance in the use of coke may be further stimulated by experiments which indicate that bituminous coals not ordinarily classed as "coking" can be made into satisfactory metallurgical fuel, by carefully investigating them and treating these coals in improved ovens.

Mere figures of production do not show real progress, for the use of the metal is a better gauge; and this is indicated by dividing the tonnage produced into the population of the United States in census years. This gives the following result:—

In 1860 the U.S. produced	1	ton of pig iron for	32	inhabitants.	
" 1870	"	1	"	21	"
" 1880	"	1	"	15	"
" 1890	"	1	"	7⅓	"

With the rapid increase in production there has been a marked decrease in the number of plants to supply the metal.

Twenty years ago (viz. 1877) the number of blast furnaces in the United States, considered as on the active list, was 716 In 1897, a similar list embraced 423 stacks, of which but about 200 contributed to produce the pig iron credited to that year.

While large furnaces have displaced small ones, the increase in size will not alone account for the result.

Improved equipment and technical knowledge applied to iron smelting has done more than anything else to secure the advancement indicated.

The most important factor in the development of the pig iron industry is the conversion of iron into steel. This is indicated by the figures which show that in the past ten years the quantity of pig iron, rated as Bessemer, has increased from 2,637,859 tons, or 40.65 per cent. of the total pig iron make of 1888, to 5,795,584, or 60 per cent. of the pig iron output of 1897.

The pig metal classed as Bessemer indicates the amount which was utilized to produce steel in converters; in addition, the open hearth furnaces required a considerable amount of pig iron.

The 5,500,000 long tons of steel ingots made in 1897 were transformed into rails, plates, sheets, nails, wire, etc., at works which were drawn to the vicinity of the blast furnaces supplying the pig iron.

It is not the furnaces alone, but the concentration of manufactories which gives value to blast furnaces as developers of a district.

Several years ago a town-site boom ran riot throughout the eastern portion of the United States, and prospective cities were laid out sufficient to require half of the population of the country to occupy their liberal areas. Most of these proposed cities were based upon the establishment of blast furnaces, although some of the sites chosen had little to commend them as locations for pig iron production.

As a result there are now few indications of a number of these prospective cities, and even their memory is, in many cases, confined to those who invested in town lots laid out through cornfields, at prices equivalent to the cost of similar properties in actual municipalities.

Over 90 per cent. of the employees about a blast furnace plant are classed as ordinary navvy laborers, the number of specially skilled or educated specialists being small, hence the supplemental processes of converting the metal and especially its manufacture into articles of use do more to advance a town or city than the blast furnaces alone. In fact, so closely are these supplemental processes associated with pig iron production, that it is only at exceptional localities where it will be found desirable to establish new smelting plants, unless they are closely affiliated with steel works, rolling mills, etc.

While pig iron is a most potent factor in the development of a district, province or nation, its manufacture cannot be made successful without the use of good business management and technical knowledge. Even with these, failure may and probably will follow the location of plants without giving the site thorough, unbiased investigation.

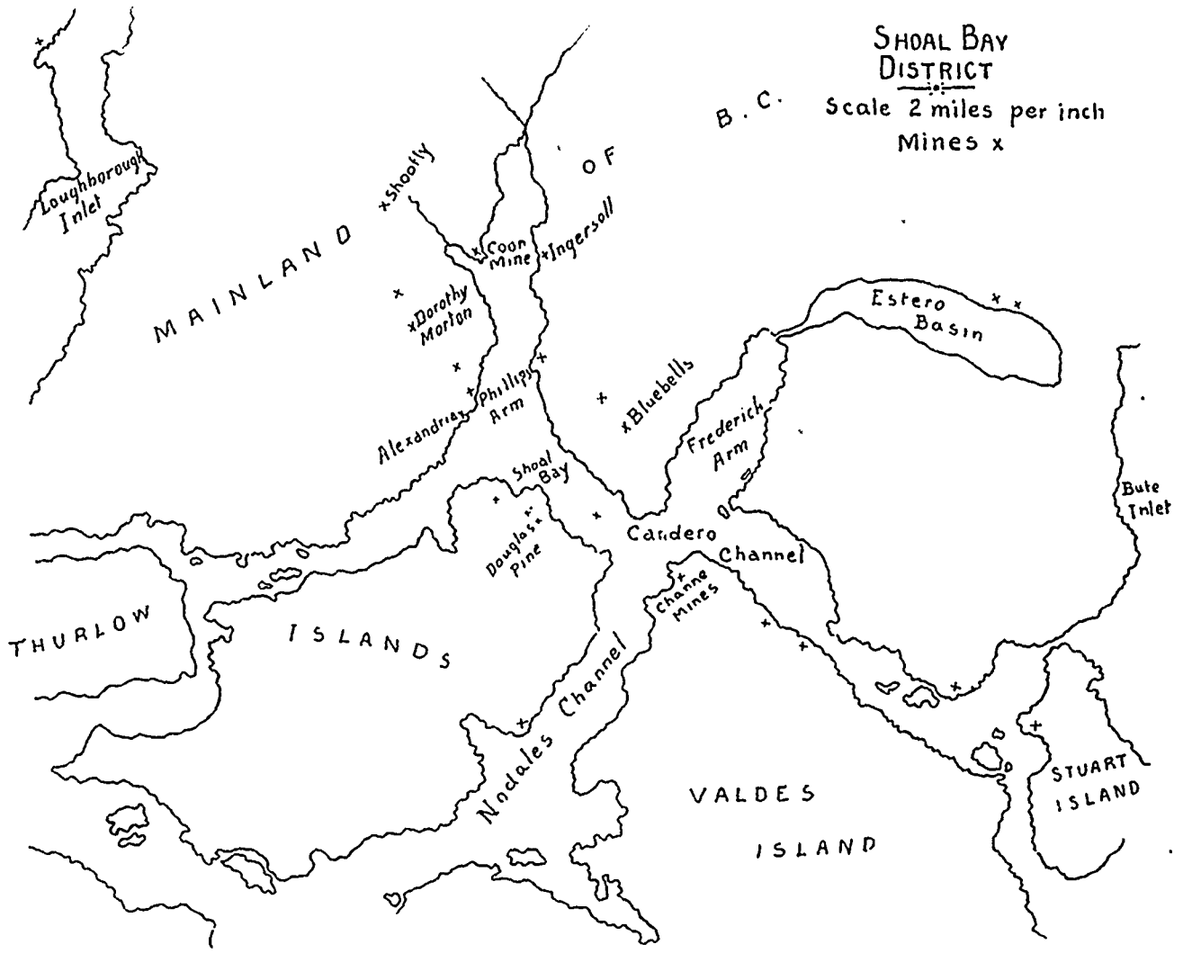
In short, all of the factors above indicated must receive careful attention in determining the advisability of erecting blast furnaces if the pig iron industry is to exert a healthy influence upon commercial development.

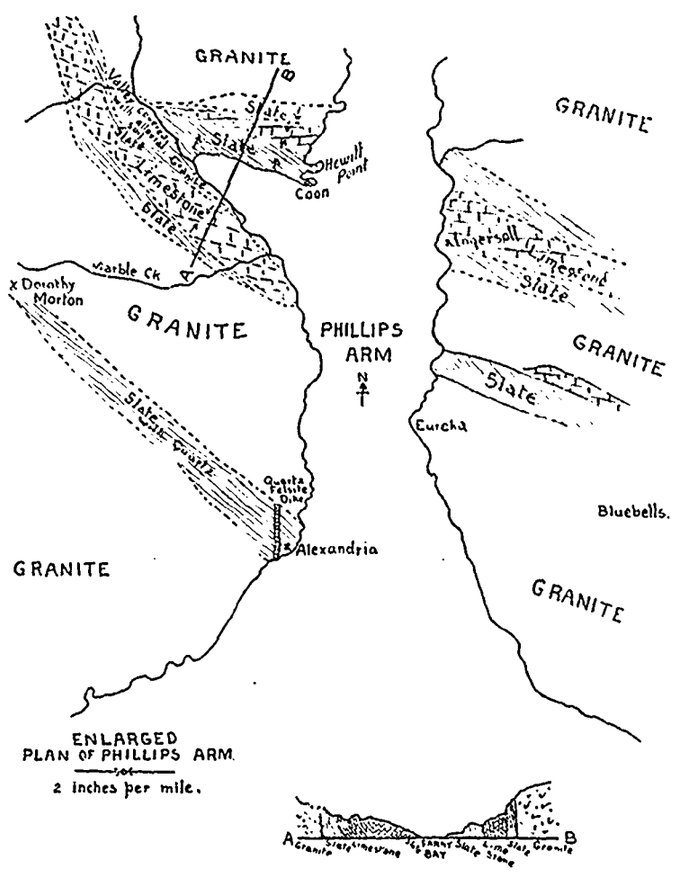
Notes on Mining on the Coast of B.C. and the Adjacent Islands.*

By G. F. Moncton, F.G.S., Vancouver, B.C.

At the present time prospecting is being carried on along the whole line of the coast of the mainland, but it has hitherto been chiefly confined to that part which lies south of Smiths Sound, as this section was more readily accessible from the settled districts. The predominant feature of the district is the remarkable way in which the coast is penetrated by inlets, many of which extend for fifty miles, and branch out into numerous smaller inlets or arms. The mountains are very rugged and heavily timbered, rising in deep slopes and escarpments from the water, without any interval of low land which can be used for cultivation. Streams are abundant, and often of considerable size. Their course is marked by deep canons. The channels between the shores of the inlets and islands are very deep, it not being uncommon to find a depth of 50 fathoms a hundred feet from shore. Abun-

*Paper read before the meetings of the Federated Canadian Mining Institute March, 1898.





Plates I and II illustrating Mr. G. F. Moncton's paper "Mining on the Coast of the Mainland, B.C."

dant traces of glacial action may be seen, and boulder clay occurs at many points. The climate is much milder than that of eastern Canada and it is rare for snow to lie for more than a few weeks below the elevation of 2,000 feet. The rocks composing the coast are granites, slates and limestones, with intrusive felspathic rocks, and some amygdaloid. There are also a few small patches of cretaceous rocks, notably at Point Rayner in the neighborhood of Cape Caution, where some work has been done on a seam of coal which is 2 feet thick and carries 7½ per cent. carbon. These strata are associated with dikes and sheets of trap, together with some volcanic ash. The exploitations hitherto carried out seem to show that these coal-bearing strata were laid down in narrow inlets such as exist at the present day in the same district, and this has rendered it difficult to define their area, but they appear to underlie about four square miles of the present land surface, and may be found to extend to a considerable distance seawards. Auriferous veins have been found seven miles north of this at Yakush Harbor and work is being carried on there. Locations have been made on many islands and on the shores of the inlets to the south, especially on Loughsborough Inlet and Cracroft Island, where copper ores occur, but the interest at present is centred chiefly on the district between Phillips Arm and Howe Sound. The first point at which any considerable amount of work was done was at the Alexandria mine, west of the entrance to Phillips Arm At this point there is a band of slate with intercalated quartz veins, which has been proved by a drift along the best vein for a length of 150 feet and a cross cut 70 feet long. As shown in the cross-cut and on the shore, the strata consist of alternate layers of quartz and slate, varying from 3 to 15 feet thick. All the quartz carries some iron pyrites and yields a little gold, but the pay streak was a seam of blue laminated quartz found near the hanging wall of the largest quartz vein, and carried the gold disseminated through very fine-grained arsenical pyrites. This was 4 inches wide near the mouth of the drift and yielded $68 per ton in gold. At 10› feet further in it was nearly 3 feet wide, but had a value of only $8. At this point it was faulted by a dike of quartz felsite and has not since been recovered. In this property it seemed that wherever the pyrites is coarse-grained the gold value is low. Further up the Arm, on the same side, are the mines grouped around Fanny Bay Of these the Coon was the first located. It has several veins in slate which carry gold associated with iron pyrites, one being 3 feet wide, but the most important is a small one cropping out on Hewet Point, which is an island at high tide. Smelter tests of this ore yielded $100 per ton. On the same claim occurs iron ore at the junction of the granite and limestone. On the west side of the bay lie the Dorothy Norton and other properties which are now being worked on the extension of the Alexandria vein. The limestones and slates lie in narrow synclinal basins between the masses of granite which form the high ridges. A good section of one of these is seen in Marble Creek. The slate and limestone seen on the bay cross the arm, and some work has been done on them there. They may also be traced, but not continuously, to the south side of Carden Channel, where they crop out for five miles continuously. Between the locations at that point and those of Fanny Bay occurs the Blue Belle, which is on the mountain between Phillips Arm and Frederick Arm. This is a property containing a low-grade ore body of great width, carrying a little copper. There is also a shoot of $52 ore. The limestones in their course west of Fanny Bay butt up against the granite and are cut by diorites, yielding where this occurs magnetite carrying some copper sulphides. In the line of the Alexandria southward are the Channes mines on Channe Island and Valdez Island. A typical one is the Hetty Green, in the drift of which the ore body occurs as a vein of quartz, which is talcose and yields traces of gold. Along this runs the pay-streak, which is a seam of quartz highly mineralized and carrying $100 per ton. It is 2 to 6 inches thick. The Estero Lagoon runs into the head of Frederick Arm. It lies almost parallel to the Cabelero Channel, and is only separated from Bute Inlet by a narrow strip of low land. Along the north side of this, at the junction of the granite and slate, are several large bodies of low-grade copper ore. A concentrating plant is being erected there by R. C. Forsyth. One mile south of the range of the Alexandria vein lies the Douglas Pine, which has shipped about fifty tons of copper ore. Many other adjacent claims show good prospects. On the west side of Bute Inlet, which is 30 miles long, occur several veins carrying copper and galena. Gold has lately been found on Ramsay Arm; Stewart Island has copper stock-works in hornblendic granite. Coming south from Bute Inlet we find many locations, chiefly on copper ores, as in Raza Island, the Hole in the Wall, Quathiaski Cove, and others. On West Redonda Island are several locations, most of which show copper and carry some galena. The most notable is the Medora, which has a vein following the line of a diorite dike in granite. Here the veins depend for their value on the presence of galena. This vein has a 3-foot pay-streak yielding 7 per cent. galena and $22 gold. Zinc blende occurs in this and adjacent claims. From the north end of Redonda is a large deposit of magnetite, from which ore was formerly shipped. On Desolation Sound occur other veins which are similar to that on the Medora, and on which work is being done. On Theodosia and Lancelot Arm are several copper deposits at the junction of the limestone and granite. This limestone crops out southward 2 miles south of Hirtuda Point. On the opposite side of the channel is Texada Island, which is the most prominent mining district on the coast at present. The most important is the Van Anda mine, which with the Raven and others occurs along the line of contact between granite and limestone. The ore from this averages $40 per ton. On the other side of the island is the Texada iron mine, which was formerly worked for iron, but now is beginning to produce copper. According to Dr. G. M. Dawson, this is a contact deposit peoduced at the junction of the granite and limestone, and intrusive felspathic rocks occur there. The ore lies in irregular bodies or chimneys and penetrates the granite and volcanic rocks as well as the limestone. In Jervis Inlet at Treasure Mountain lie several bodies of chalcopyrite. The country rock is quartzite, slate and granite, which are traversed by intrusive igneous dikes. These bodies of ore appear from the work so far done to be likely to be of considerable economic importance. In Howe Sound zinc blende occurs on Gambia and Bowyer Islands in considerable quantity. Chalcopyrite occurs north of Vancouver eight miles and also on the North Arm, but very little work has yet been done. The district as a whole has as yet been very little developed, and hardly prospected away from the shore, but is likely to rival the more developed sections of this Province eventually. For much of the information relating to the district, especially as to the southern part of it, I am indebted to Mr. A. J. Colquhoun, M.E.

In order that our comments may not be construed as in any way influenced by political considerations at a time when Yukon matters are permanent in Parliament, we have held over until our next number our promised review of "Ogilvie's Official Handbook" and the amended Yukon Regulations.

The next annual meeting of the members of the Mining Society of Nova Scotia will be held in the Halifax Hotel on Wednesday, 6th prox. A number of papers will be presented of interest. The annual dinner will be held in the same place.

The New Provincial Mineralogist for British Columbia.

We are pleased to be able to announce that the appointment of Provincial Mineralogist for British Columbia, about to be vacated by Mr. W. A Carlyle, has been offered to, and, we understand, has been accepted by Mr. R. G. McConnell, B.A., one of the ablest members of the staff of the Geological Survey of Canada.

Mr. McConnell graduated from McGill in 1879 with a B.A. degree in Arts and first rank honours in Science, and the Logan prize. In the same year he joined the staff of the Survey, his first Geological work being done on the Peace River expedition from West Coast to Winnipeg, as assistant to the present Director, Dr. Dawson. In the following year he was employed in the Laurentian area of Quebec, north of the St. River, and during 1881, in what is now Southern Alberta, again as assistant to Dr. Dawson. He wintered at Calgary and continued the explorations alone in 1882, his observations being embodied in the Report on the Bow and Belly River District. In 1883 and 1884 he had charge of explorations again in the North-West Territory in the Cypress Hills and Woody Mountain region, the work being fully described in an elaborate report and map published by the Survey. In 1885 and 1886 he was engaged in the construction of a geological section across the Rocky Mountains, and in 1887 in a general examination of the Liard, Mackenzie and Yukon Valleys in connection with the Yukon exploring expedition. In this great and extremely hazardous work of exploration Mr. McConnell ascended the Stickine and came down the Liard, wintered at Fort Simpson on the MacKenzie, and in the following year descended that river, crossed the Rocky Mountains inside the Artic circle to Porcupine River, descended the Porcupine and up the Yukon, crossing the Chilkoot Pass to Lynn Canal, the total distance covered from the time he left the coast at Fort Wrangell until he reached it again at the head of Lynn Canal being about 4,000 miles, 3,000 by boat and canoe, and 1,000 on foot. In 1889 and 1890 he examined and published a Report on the Peace and Athabasca Valleys, with special reference to the existence of petroleum in this region. After a year's holiday spent in Europe he resumed his investigations on the Rocky Mountains, north of the line of the Canadian Pacific Railway, and in 1893 conducted an exploration of the Finlay River and Omenica regions in British Columbia. The last three years have been spent by Mr. McConnell in West Kootenay, among the mining camps, gathering data for a geological and topographical map of this important mineral producing district and for a Report on its geology and mineral resources.

The Province of British Columbia is to be congratulated on the acquisition of a gentleman of sound technical training, of good judgment, with an extensive acquaintance and experience in the field, one in every way suited to the responsibilities of its Mining Bureau, and a worthy successor to our old friend, Mr. Carlyle. We are indebted to Mr. W J. Topley for the use of the photo of the new Provincial Mineralogist.

STEEL WINDING ROPES IN GERMAN COLLIERIES.—For winding purposes in German mines, nearly all the ropes are made of steel wire and of round section, with from 120 to 180 kilogrammes per square millimetre (76 to 114 tons per square inch) breaking strain. During the last few years twisted ropes of locked construction have been made in Germany by Felten and Guillaume, with wire of special sections. A strand rope is twisted from strands, each of which has previously been made with wire ; and the strands—generally six or eight, but sometimes even nineteen—are uniformly laid round a hemp core and arranged spirally. If, however, the ropes have to be more than usually flexible, the strands also have hemp cores, and in this case they generally consist of eight strands of 12, 20, or 30 wires with nine hemp cores altogether, one in the middle of the rope and one in each of the eight strands.

Notes on the Michipicoton Gold Field.*

By A. W. WILLMOTT, M.A., B.Sc., Toronto.

During the summer of 1897 some fine samples of fine gold were obtained on the shore of Wawa Lake, a few miles north of Michipicoton on Lake Superior. Interested parties gave most glowing accounts to the local newspapers and these were widely copied. The marvellous accounts of the Yukon were fresh in the minds of all, and here was another Klondike close at hand. Prospectors flocked into the district from points as distant as New York and Minnepolis, and special correspondents were sent into the field by enterprising journals.

As the region was almost unknown, I was asked by Mr. Blue of Bureau of Mines, to make a brief geological examination of it. A few facts gathered during this visit, I thought might be of interest to the Institute.

In volume VIII. of the Geological Survey Reports, the learned director states: "There can now be very little doubt that every square mile of the Huronian formation of Canada will sooner or later become an object of interest to the prospector, and that industries of considerable importance may yet be planted on this formation in districts far to the north, or for other reasons at present regarded as barren and useless." The first part of this prediction, made only two years ago, has already been fulfilled in the Michipicoton district. One hundred and eighty-six locations have already been taken up, and these mainly in the two months of September and October.

The Huronian area in this district is not yet well defined. In a map of "The basin of Moose River," published in 1883, Dr. Bell has laid down the geological boundaries as determined by traverses of the canoe routes. Much of the map is hypothetical, and my own explorations lead me to believe that the Michipicoton Huronian area is much smaller than represented on this map.

So far gold-bearing quartz has only been found in Huronian rock, although considerable quartz is found in the Laurentian gneiss near the contact of the two formations.

By far the greatest number of the locations are in the vicinity of Wawa Lake, six to ten miles north-east of Superior. The Dickenson, or MacKay claim, the first discovered, consists of four fairly parallel veins running to the north-east and dipping about 35° to 45° to the north-west. Two other veins cut these on the angle. The rock is a somewhat massive hornblende schist, containing a little pyrite. The veins vary in width from one to four feet. Specks of free gold are easily found in pieces chipped off with a hammer. Eleven essays ran from $13 to $145 in gold.

Many of the veins of the region occur in quartz porphyry. The Johnston-Lawlor vein is an example. It has been traced over a mile, and free gold taken from it at a number of points. On Lawlor's claim three assays yielded $285, $324 and $693 respectively.

Besides Wawa Lake, locations have been made on Dog Lake, near the Canadian Pacific, and on Manitowick Lake, twelve miles to the south-west.

No development work had been done up to the time I left the district, so there is little on which to base an estimate of the possibilities of the region. There is certainly quartz in abundance. On the side of precipitous hills a wall of quartz is frequently found. Numerous veins 10 to 15 feet wide have been reported. Many, probably the majority, of these are of the bedded variety. Others are true fissure veins.

As to the contents of the quartz one has only the assays to guide him, and these are notoriously misleading. I have already mentioned

*Read before the Montreal meeting of the Federated Canadian Mining Institute.

some of the best. Many of the samples I took myself from other properties have yielded only traces of gold or nothing.

In the kind of rocks, in the mode of occurrence of the quartz, in the minerals in the latter this region very closely resembles the Lake of the Woods and the Sudbury districts. One may fairly expect that a similar development will take place here, and that with the increased interest taken in mining, that the development will be much more rapid The country is easily accessable, wood and water are abundant and considerable water power is available.

The Michipicoton district has been declared a mining division and now comes under the provisions of Part III. of the Mines Act. By this Act all mineral rights are withdrawn from sale or lease. Annual miner's licenses are issued, and those holding them may stake out and work claims. A claim unworked for three months, except during the winter time, may be forfeited.

Gold-Bearing Reefs and Placers of Northern British Columbia.

By WILLIAM HAMILTON MERRITT, F.G.S., Assoc. R. M. S.

Placers.—Even before the rich discovery in the Klondyke district, in the North West Territories, renewed attention for the past few years had already been given to the placers and quartz reefs of Northern British Columbia, particularly in the Cariboo district, but also to some extent in the Lillooet district. Some notes on their general character, both from personal investigation and from results obtained by others, may not be without interest at the present time. Of the placers it is my intention to treat more particularly of types of "deep-diggings."

The placer producing areas of both of these districts are similar. The country is very mountainous. The country rock is schists, for the most part, in varying degrees of metamorphosus, from soft talc, schists to schistose-gneisses. These schists are interbedded with inummerable quartz veins and bunches, running chiefly along the line of strike of the schists and in the joint structure of the formation. Some well defined strong veins can be followed for considerable distances, but the quartz generally occurs most irregularly, having more the character of segregations of quartz in the buckles and joints of the distorted formation.

Sometimes the irregular quartz masses seem to follow along the line of shear zones and are met, one after the other, with abrupt terminations and commencements. In these cases fault lines are rarely discernable, the occurrence indicating formation of the qnartz after distortion rather than that the irregularity is due to direct faulting disturbance. Faults, however, can occasioually be seen through the veins or the quartz bodies.

The above remarks are more particularly applicable to the Cariboo district, but a cursory investigation of the Lillooet district seemed to show similarity. The Gold Commissioner of the latter district describes the conditions as follows: "I have referred to the Geological disturbances that are in striking evidence everywhere on Cayoosh Creek. I would infer that quartz mining on this Creek will be beset with many difficulties, which will require careful thought

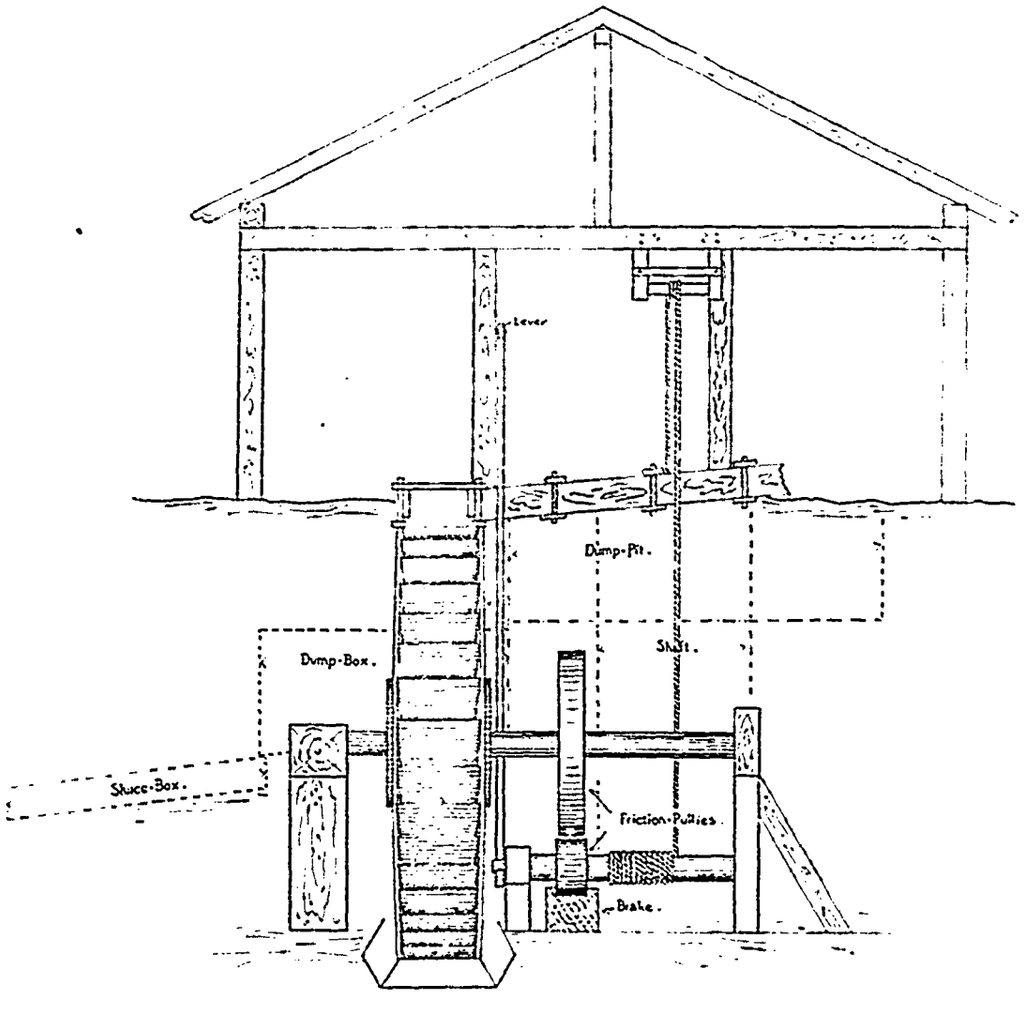


Fig. 1

Plate illustrating Mr. Hamilton Merritt's Paper "Gold Bearing Reefs and Placers of Northern British Columbia."

and skilled management in dealing with and overcoming them. The blanket ledge will be in evidence, possibly rich, but suddenly vanishing or twisting out of shape and lost for a time. Wide areas of the numerous small quartz veins and auriferous schists may be worked profitably on the open face or quarry system, and in turn they will be blocked by intrusive dykes of worthless material." Instances have occurred in Cariboo of large pieces of free gold having been found in these small irregular veins or "pockets." Therefore it may be said in a general way of the localities above alluded to, given great areas of these mountain sides, tributary to a confined valley, ideal conditions exist for the disintegration of the soft schists and the concentration of the gold, when the great rush of snow water comes down in the early summer.

The general character of the ore will be dealt with further on in this paper.

It is generally a well known fact that Cariboo district is commonly reported to have produced some fifty millions of dollars worth of gold from her placers, and Lillooet District some $1,200,000 (chiefly from Cayoosh Creek). Practically all the gold has been taken from deep diggings.

Mr. Amos Bowman, M.E., stated in his report on Cariboo, in the 1888 publication, of the Geological Survey of Canada: "Cariboo has not only been the mainstay of gold mining in British Columbia for many years, but has proved, for its area, one of the best placer mining camps in the world."

Nearly all the above mentioned out-put has been produced by groups of miners working as partners, or so-called companies. The same thing will undoubtedly be done in the same manner in the Klondyke district. In Klondyke, however, the disadvantage exists of having frozen gravel to work through, but in Cariboo the miners constructed large overshot wooden water-wheels, to give power for pumping and hoisting their gravel. The friction gear and general simplicity and effectiveness of their machinery was admirable for economical working at shallow depths.

Such an arrangement for hoisting is shown by the accompaning sketches (Fig. No. 1 and 2), illustrating a deep diggings placer still operated in the Cariboo district, on the old day model. Everything about the plant is made of wood, which is very abundant in these districts, there being no iron used in its construction.

The gravel, and two feet of bed-rock is dumped into the "dump-pit" along-side the shaft head. This dump pit is 12 feet long with grade of one inch to the foot. The bottom is 12 inches wide, and the sides, which are from four to five feet high, slope outwards and are four feet wide at the top. This box should hold the gravel taken out between two sets of timber, viz: some 1,750 cubic feet.

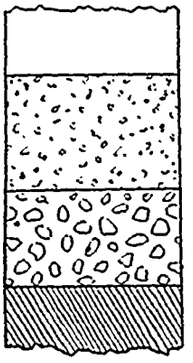
The advantage of a dump-pit is that water can be kept running on the gravel and bed-rock, and it gets time to slack, and the gold to settle, before the clean up.

Below the dump-pit, the "dump-box" is situated. This may be 12 ft. to 18 ft. long with 1 in. grade to the foot, and its width 3 ft. with a depth of 20 in. to 2 ft. Below the dump-box the sluices, 12 ft. long, 12 in. wide and 12 in. high, run with about a grade of 1½ in. to the ft., when there is ample water. The placer shafts are generally small, in this instance 3 ft. x 5 ft.

The work at the face of the gravel on the bed-rock is interesting, being the well known method of "spilling." (Fig. No. 3).

The width of the working face is 10 ft. The operation of putting in a new set is as follows:

A "bridge" is driven in under the ends of the lagging resting on the advance set of timbers, three "keys," or wedges, are driven in to raise up the bridge, then "lagging" for the new set is started in between the keys and driven as far as it will go. Meantime gravel is being removed and some 2 ft. of the bed-rock is picked up. The coarsest gold as a rule being found in cracks in the bed rock. Some 18 inches beyond the set of timber a "fore-set" is put in to catch the lagging. This fore-set is lighter than the ordinary sets and is merely temporary. The lagging, which is cut in lengths of 4 ft., is then driven in and is caught by the "fore-set," which holds it up until it is driven in some 3½ ft., when another set of timbers, with posts and crown-tree 1 ft. square is put in, care being taken to leave room above for bridge and keys. Side lagging is also driven as well as the top lagging. All the lagging is tightened by wedges not to allow the ground to move or settle. It is very important to keep the ground solid above, if at all possible, for if a run once starts it is sometimes impossible to stop it. Two men should put in one set in each eight hours shift in ordinary ground. The same may be said also with regard to the speed of drifting in the gravel. An ordinary condition is to find "gravel" on the "bed-rock," above that "chicken-seed" or fine gravel, over the latter "slum" or fine running silt often occurs. If this latter gets started it is very difficult to stop. Often times workings had to be abandoned. The order varies somewhat, but gravel is always on the "bed-rock." Clay sometimes takes the place of slum and then acts as a cover.



It is a great advantage where a drainage tunnel can be driven, as is the case in the workings just described, for then pumping is unnecessary. Where pumping is necessary it is, in many instances, advisable to sink the main shaft in the solid rock, (a "bed-rock shaft") and drive from it into the old bed of the river, as is being done at present on Slough Creek and Willow River. In the former case the old river bed was located at 287 ft. below the surface of the present Creek by boring through the gravel with an hydraulic jetting machine. A drain tunnel of 2,150 ft. was run to the old main working shaft to relieve it of water, and, from the last available information, this has been continued to the rim rock, in which a bed-rock shaft will be sunk to a point below the deep channel and then a cross-cut will be driven into the channel from the bottom of the shaft.

In the case of the Willow River lease a similar drainage tunnel, or adit, has been run to the rim rock and a three compartment shaft 6 x 12 ft. had been sunk 100 feet to the rim rock, and 112 ft. deeper in the bed-rock. Twelve feet of the bottom of the shaft is left as a sump, and a cross-cut 6 x 5 ft. was being driven to reach the old channel, according to latest available intelligence. An Ingersoll-Sergeant drill is used and a blasting battery, and about 100 ft. a month progress was being made. Mr. Fred C. Laird, the manager, reports that all the tunnel has to be timbered, and a great deal of extra work is caused by rock caving.

The machinery comprises a 50 h.p boiler, a pair of 35 h.p. engines, an 18 in. Cornish pump, two 12 in. Cornish pumps, one horizontal steam pump, a 16 h. p. hoisting engine with upright boiler.

Careful boring, to locate the old channel, was also previously done in this case with an hydraulic jetting machine, commencing with a 6 in. hole and decreasing to 3 in. It is said that "prospects" of gold were raised by the drill.

These last two examples are types of modern operations to reach deep-diggings and work them. The first mentioned is now working, but is alluded to as a type of an old-time plant.

There is no important existing example where a tunnel drains the old deep channel while it is being worked in the usual manner. A condition exists, however, where this can be done in the lower, and yet unworked, ground on Lightning Creek, and a company is under course of formation to carry out this project.

On Willlams Creek a long drainage tunnel relieves the lower part of the old worked ground of its water, and an hydraulic lift is being installed to raise and wash the whole of the gravel down to the old channel.

There are several other notable enterprises of a modern character being developed in the Cariboo district. The operations of the Cariboo Hydraulic Co. on the south fork of the Quesnelle River is undoubtedly the most important of these.

The note of the Gold Commissioner in his report of 1890 on the discovery of the ground there worked, is interesting. He states: "The opinion has prevailed for many years among our most experienced miners from California and Australia, that, judging from the formation of the country, there exists, and ultimately would be found, in this district, immense obliterated river channels traversing the country upon a higher level than the present streams, which in crossing the former, in many instances, received therefrom their chief supply of precious metal. The first of such ancient river channels would now appear to have been discovered on the south side of the south fork of the Quesnelle River."

Examples of Placer Yields.—The two richest creeks in Cariboo were Williams' Creek and Lightning Creek. Some examples of yields may be of interest. According to the reports of the Gold Commissioner of the district, Williams' Creek and its tributaries yielded over nineteen millions of dollars, and Lightning Creek and its tributaries some ten millions of dollars. In the Lillooet district Cayoosh Creek was most productive and yielded nearly a million dollars.

On Williams' Creek the Aurora and Cameron claims each yielded some $800,000, a few other claims over half a million of dollars, and a number from $200,000 to $300,000, 108 claims yielding $7,355,000, being some $150,000 on an average per claim. On the Dillar claim on April 13th, 1863, three men washed up 104 lbs. (2,080 oz.) in the afternoon. The Gold Commissioner, Mr. Bowron, states he has seen 1,000 ounces washed up in the Aurora claim for three days, rim-drifting underground.

On Lightning Creek an approximate statement to November 1st, 1875, published in the report of the Minister of Mines of British Columbia, showed that up to that time 13 claims had yielded an

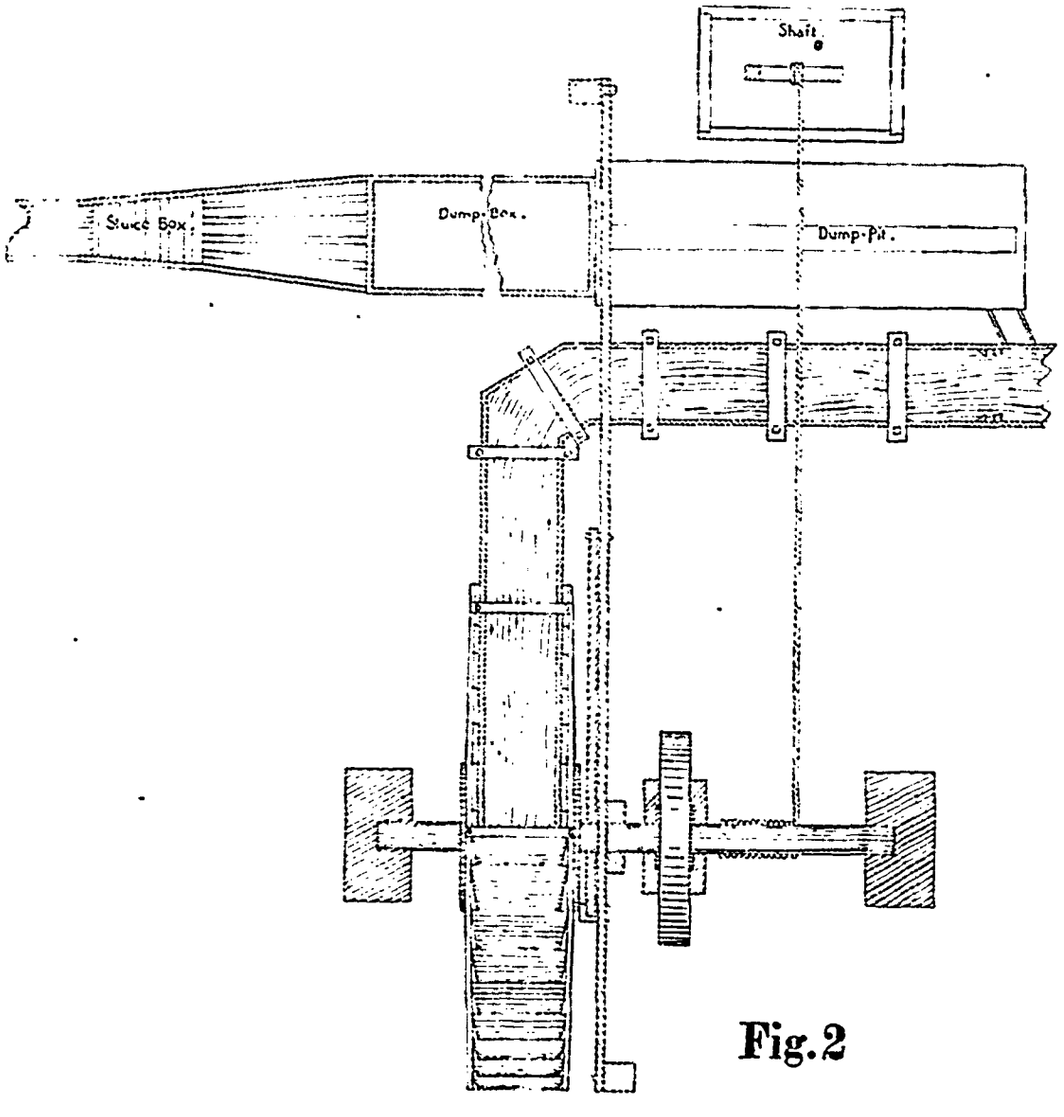


Fig. 2

Plate illustrating Mr. Hamilton Merritt's Paper "Gold Bearing Reefs and Placers of Northern British Bolumbia."

average yield of $167,636 each—the Victoria, $451,642; Van Winkle, $363,983; the Vancouver, $274,190, etc.

It is commonly reported that the ultimate yield of these claims was much higher, and according to a report made on the spot by Mr. C. J. Seymour Baker, C. E., the following yields are given: Van Winkle, $2,000,000; Vancouver, $800,000; Lightning, $750,000; Spruce and Shallow Ground, $700,000; Point, $600,000; South Wales and Victoria, $500,000, etc.

On Lightning Creek the best weeks' wash-ups were:—In the Vuncan claim, 400 odd ounces; in the Vancouver, 603 ounces; in the Victoria, 964 ounces; and higher up stream in the Van Winkle, $1,570 ounces, from 13 sets of timber, or 455 square feet, (viz., about 3½ ounces per square feet of bed-rock, or 120 ounces per set); and South Wales, 1,000 ounces, for the week ending October 9th, 1871.

The best month's yield in the Van Winkle claim gave:

Product for week ending 5th September, 1875..	$58½ ounces		$15,169.69
" " " " 12th " "	1251 "		22,106.67
" " " " 19th " "	1570¼ "		27,749.87
" " " " 26th " "	$93½ "		15,790.96
" to September 30th (4 days) "	495¼ "	=	754.64
Total for September, 1875.....			$89,571.83

These figures are from the original books of the Van Winkle Co., in the possession of the Gold Commissioner.

creek, while again in Lowhee Creek he has found free gold in quartz in place corresponding exactly in fineness with the placer gold of that creek.

Quartz.—The natural inference is that it would be very desirable to get at the matrix which yields the rich placers.

Mr. Bowman, in his report above alluded to, states: "It would appear reasonable to assume the existence of rich quartz lodes, from which, by natural processes of waste, the alluvial deposits have been supplied. Consequently both in Cariboo and Lillooet there have been quartz excitement from time to time."

Prospecting is very difficult owing to the enormous amount of gravel, or debris, from the easily disintegrated schists, covering the mountain sides. Float from quartz veins is everywhere, but the veins are seldom seen on the mountain sides, but are constantly met with when drifting is done on or in the bed-rock. The veins on Burns' Mountain were discovered by a placer miner who started to drift in the snow!

The general geological features of the quartz veins has already been alluded to. Strong and apparently persistent quartz reefs can be seen, of which the accompany small photograph may serve as illustration. The usual quartz occurrence is, however, accompanied by the greatest irregularity, as already indicated.

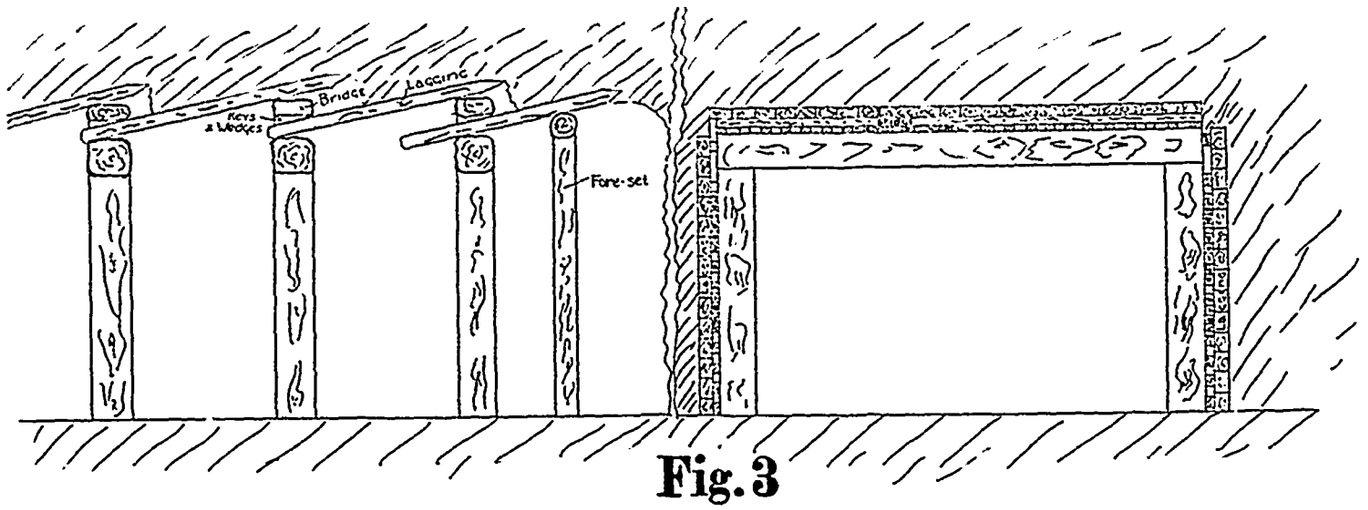


Fig. 3

Plate illustrating Mr. Hamilton Merritt's Paper "Gold Bearing Reefs and Placers of Northern British Columbia."

The best pan on record on the creek from favorable crevices was got by Harry Jones in the Van Winkle, 101 ouuces; other big pans on record are 72 ounces, and numbers of 30 ounces and upwards were obtained.

The largest nugget in Cariboo was from the Butcher Bench, on Lightning Creek, and it weighed 37 ounces. From the deep channel another nugget was taken on the same creek, weighing about 30 ozs.

A curious incident occurred in drifting a drainage tunnel on the Vancouver claim in the same creek. A 20 ounce nugget was found at some distance from the "lead," or old deep channel, and no "pay" whatever was found in the drift before or after.

Sometimes not a colour can be got within one foot of the "lead."

The varying values of the gold is interesting. Such creeks as Stevens', Wolff and Beggs (putting into Antler Creek), the value of the gold is about $14.50 to $15.00 per ounce; Williams' Creek, $16.00 per ounce, and Lightning Creek, $17.25 per ounce.

Tributary creeks to Lightning, such as Nelson, Chisholm and Anderson Creeks, $17.50 to $19.25 per ounce.

Mr. S. J. Marsh of Barkerville points out not only the well known fact that each creek has its characteristic gold, but that he has found different kinds of gold varying from $12 to $18 per ounce in the same

Instances will no doubt be found where it will be profitable to mine and treat the entire belts of quartz and schists, but the high prices of transportation, material and wages, makes the consideration of quartz mining a serious problem.

It would be thought that where rich placer ground was found free milling would be the characteristic of the ores. This has not so far proved to be the case. Examples of nuggets as large as 10 and 15 ounces are to be seen in the country, mined out of the irregular quartz stringers. The men who carry on this work in California are known as "pocket-miners," but it has not yet become an industry in Canada. It is found as a rule that the average ore of veins contiguous to such stringers is not free milling; only a small portion of its value can be extracted in the battery or on the plates of a stamp mill. Many quartz veins in this country are absolutely barren, so far as can be seen at or near the surface. The general characteristic of the veins, however, is that they carry a large proportion of iron pyrites, some also carry galena and a little zinc-blende. Iron pyrites is also generally found occurring abundantly in a crystalline form disseminated through the schists, and particularly near mineralized quartz veins.

Tests on a small scale have been carried on by myself on ores from various localities in Cariboo, and while some ores run as high as

$30.00 to $40.00 in gold, only a very small proportion of it can be saved in the stamp mill, in the instances that came under my attention. As an example, an ore assaying about $30.00 a ton gave a varying extraction free milling of from nil to $5.00 per ton.

Cyanide extracted 85 p.c. of the values in 70 hours. By concentration the loss in slimes was considerable, and close concentration to get rid of the dolomite associated with the ore, with a view to chlorination tests, gave a 6 p.c. yield in concentrates, which assayed gold, 9 ozs., 10 dwt., 21 grs.; silver, 5 oz., 11 dwt., 18 grs.; lead, 10.08 p.c., and traces of lime and magnesia.

Other ores in the district give a yield as high as from 15 to 17 p.c. concentrates. An example of one of these gave an assay of from $8.00 to $12.00 in value, with a yield of some $2.75 in free gold and a loss of about $2 00 in the tailings. Cyanide extracted 85 p. c. in 72 hours, and most of the ores, where rich and constant enough to pay to mine, will probably be treated by this process. The oxidized ores of the out-crop may cause trouble, but, as far as development has proved to the present, it is astonishing what a short distance oxidation has penetrated into so friable and disturbed a formation.

Chlorination would treat most of the concentrated ores admirably, but as exploited so far, their usual grade is too low to allow profitable treatment by this method, and, if the extraction above alluded to can be relied ou generally, the cyanide will be cheaper.

Mr. S. J. Marsh, M. E., of Barkerville, reports to the Gold Commissioner in the 1896 report of the Minister of Mines, regarding his results in testing 265 tons of ore with cyanide, to the effect that the results obtained were most satisfactory, but at the same time he points out that in certain cases he has not had conclusive results from some heavily mineralized ores, for which he favors part treatment by concentration and chlorination.

The government of the Province of British Columbia have been extremely liberal in their appropriations to assist the development of quartz mining. In the neighborhood of Barkerville they have assisted in the erection of a ten stamp mill, they built a chlorination plant and have latterly assisted in the erection of a cyanide testing plant. They also maintain an assay office at Barkerville, which is a great boon to those who are investigating quartz propositions.

With regard to the prospects of quartz mining in Cariboo, one can sympathize strongly with the expression of the Gold Commissioner who states in his official report: "If the mines of the Cariboo district were given a railway, which would mean cheaper supplies, machinery, etc, they would give lucrative employment to thousands, where at present but hundreds are employed."

Ultimately there can be no doubt about the successful development of quartz in northern British Columbia, but, as the Gold Commissioner points out, the railway question is of first-class importance in this connection. With that question settled immense quartz developments will arise, and by leaps and bounds British Columbia will forge to the front and take her place with the greatest producers of the precious metals in the world.

ACTIONS AGAINST THE LE ROI.—There are four actions brought by employes pending in the County Court of Kootenay against the LeRoi Mining and Smelting Company, for damages to life and limb, that aggregate $20,000.

LAKE OF THE WOODS BULLION.—The Mikado Gold Mining Company, Limited, announce the receipt of a cablegram from the mine manager stating that during the month of February the mill crushed 1,071 tons of rock, yielding 550 ounces of gold.

The Halsey Pneumatic Pump.

By CHARLES PERGIE, M. E., Westville, N. S.

In bringing before the notice of this Institute the Halsey Pneumatic Pump, the writer does not claim anything original for the system of pumping water by the direct pressure of air. The system, though well understood for very many years past, has found little favor in actual mine practice, and this, no doubt, owing to the fact that there has not been, until quite recently, a satisfactory pump on the market.

There are now working at the Drummond Colliery two Halsey Pneumatic Pumps. The first was put to work eighteen (18) months ago, and so satisfactory has it proved that the writer had no hesitation in ordering a second, which has just been put to work. During the eighteen months the first pump has been at work it has not cost one cent in repairs; it is automatic in action and requires little or no attention, and shows a saving in consumption of air of at least 21 p. c. over and above that of a straight line plunger plump, formerly employed to do the same work.

A test was made in the mine with the Halsey and the straight line pump under identically the same conditions, and against the same vertical head. The test was made on a slope 414 feet long, and against a vertical head of 120 feet. The pumps were placed one on each side of the slope, each took its water from the same source, and delivered it at the same point. The compressor at the surface is distant 3,000 feet from the pump; the pipe line consists of 5 inch pipes for the first half, and 4 inch for the second.

When making the test for each separate pump all other work was stopped, and the compressor was simply to supply air for that particular purpose. Indicator cards were carefully taken at the compressor engines, and these brought out the fact that to do the same amount of work under similar conditions, the Halsey pump consumed .41 h.p. per gallon of water pumped, as against .52 h.p. for the straight line pump, or a saving of 21.16 p.c. in favor of the Halsey pump.

It will be readily seen that if the air supply is of a higher pressure than that required to lift the water, the pump will be filled with air at full pressure, while air at a more moderate pressure would do the work. On this account, where the pump draws its air from a general supply, the throttle valves should not be opened any wider than is sufficient to operate the pump at the required speed.

The makers of the Halsey pump claim for it the following advantages:

1st. The automatic feature of the system by which it is impossible for the pump to either pump itself dry, and in consequence run wild on the one hand, or to fail to keep up with the supply of water and thereby flood the workings on the other. Up to its limit of capacity the pump simply takes its water as it comes, either slowly or rapidly.

2nd. The absence of all fitted or finished parts in water chamber and consequent durability under adverse conditions, such as gritty or acid water.

3rd. The utilization of the pipe line to its fullest capacity, the delivery of the pump not being measured by a certain number of strokes per minute, but by the capacity of the pipe to carry the water, the pump being presupposed to be proportioned in accordance with the pipe employed.

4th. The absence of stuffing boxes or packing of any kind about the valve motion.

5th. The absence of adjustments of any kind to adapt the pump to different conditions of pressure, etc., it being only necessary to put the pump in the water, connect the pipes and turn on the air.

6th. The property of the pump by which, if necessary, it will work when completely submerged or drowned.

Another feature might be named among the advantages for the pump, and which the makers do not appear to have laid claim to, viz: that the entire working parts of the pump can be dismantled and taken to the surface for repairs if need be, without disturbing the main tank. By loosening the bolts which connect the plate to the neck piece, the entire mechanism can be bodily drawn out.

The action of the pump is as follows:

The pump being submerged water is supplied through the valve 9, and discharged through the valve 10; compressed air is supplied through the pipe 11. In operation the pump is submerged in the sump up to about the line *a a*. The water flows in by gravity, filling the interior of the tank. As it does so the float rises with the water, and when the tank is full the float engages with a collar near the top of the vertical rod 3, thereby tripping the supplementary valve 4, and through it operating the main valve and admitting air directly to the surface of the water. When this occurs the pressure of the air forces out the water, and as it falls the float falls with it, being finally caught by the stop and guide 5. 5. As the water continues to decend it uncovers the sinker 2 which has its weight, while under water, counterbalanced by a ball weight inside the upper casting. As the water decends below the upper edge of the sinker, the weight of the latter pulls the rod downward and reverses the valves, thereby discharging the air from within the tank and allowing the water to flow in again, when the operation is repeated. It will be seen that the operation of the pump thus depends upon the inflow of water, and should the water supply be restricted the pump will simply wait until the water has risen to about the line *a. a* before the valves operate. On the other hand if the water comes faster this pause will be shortened, the pump thus accommodating itself to the inflow of water up to the point where the flow of water matches the ultimate capacity of the pump. On the other hand, should the operation of the pump be suspended for a time so that it becomes drowned, it will still work in the ordinary way up to its full capacity until the water level has again been brought down to the line *a. a*. An external hand lever is attached to the valve rock arm in the upper casting, so that in case of need the pump can be operated by hand and thus draw down the water level until the sump is emptied and the entire pump exposed.

Notes on the Ventilation of a Deep Metal Mine as Affected by Seasonal Changes of Temperature.

JOHN E. PRESTON, McGill University, Montreal.

For a number of years past it has been noticed at the Eustis mine that the hot weather of summer always causes general disorder in the natural ventilation, which is generally sufficient. The first signs of this always came in the form of bad air shortly after a hot spell, if the latter lasts for more than three or four days. The miners working in drift using hand drills are the first to notice it, and it then soon spreads all over the workings. The effect is usually shown by a slight difficulty in breathing, and is particularly noticeable on the ladders, to men going up from work. As is always the case where candles are used under ground, they form an excellent index, and a slight change in the air is easily shown by the candle flame, for while generally one candle flame gives sufficient light to work with, two candles during the hot weather will hardly light one on his way down, even when walking very slowly, and while at work a man will need as many as six candles burning at once.

In the following paper the causes of this unsatisfactory ventilation will be considered, the means taken to better the condition described, and a series of analyses of the underground air will be appended.

First to be considered are the causes that tend to make these changes in the underground atmosphere.

We find that there are several operations going on in a metal mine which are constantly tending to render the air in it unfit for supporting life, *viz.*:

(1) The burning of candles;
(2) The explosions of powder, dynamite, etc.;
(3) The respiration of the workmen;
(4) A constant reduction of the air by the acid waters of the mine.

Of the above the first three increase the percentage of carbonic acid in the air, and all four decrease the percentage of oxygen and thus vitiate it. The lights used are the ordinary paraffin candles and are one of the causes of the greatest loss of oxygen, as two candles consume as much oxygen as a man

The explosive used in the mine is a 40 per cent. dynamite and the resultant gases are much lighter and thinner than those of ordinary powder smoke would be. They contain among other things carbon dioxide, but sulphurous and nitrous acids are not evolved. But the ore is a chalcopyrite containing in some cases over 50 per cent. sulphur, and it very often happens that when, in blasting, a heavy charge of explosive is used, that the ore is broken up into dust and fine fragments which are so highly heated by the explosion that they are "wasted," producing sulphurous anhydride in dangerous quantities.

It is not necessary here to enlarge upon the effect on the atmosphere of the respiration of the miners, except to say that as there are about 50 men employed underground, and as the air which is exhaled from the lungs of a man contains 4 p. c. of carbonic acid gas, in drifts and confined spaces not well ventilated, the air soon gets very impure and dangerous to breathe owing to the carbonic acid thus produced. Although the mine is remarkably dry, there is always a little water and moisture on the walls and in the shafts, and owing to its acidity it is constantly absorbing oxygen from the air, and, acting on the ore forms salts of copper. The mine is situated on a hill and the shaft is at the summit, as the outcrop of the vein is at that point. At a distance of 500 feet from the surface, measured in the dip, the shaft is cut by a horizontal tunnel, which opens in the hillside

This adit is now altogether used in the working of the mine, the portion of the shaft above this level being used for ventilation and for carrying the smokestacks, as the hoisting engines and boilers are placed at the junction of the tunnel and shaft. As most of the miners walk to their different places, there is a stair and ladder-way which extends to the bottom. The course of the ladders is along one side of the mine for about one half of their depth. This portion is bratticed from foot-wall to hanging, leaving a gangway averaging 20 ft. wide, forming for this distance a ventilating shaft. The air for eight or nine months of the year enters the adit, follows down this air shaft and returns to the surface through the stopes and inclined shafts. Most of the mining is done by machine drills, and as they use compressed air for power, the exhaust furnishes a very considerable supply of fresh air to the miners. Also the cars running up and down the shafts create an air current which is of especial benefit to the night trammers.

If now the ventilation due to natural causes be considered, we find that owing to the underground temperature being constant, in the summer the conditions causing the movements of air are quite different to those in winter.

Taking 70° as an average temperature of the air during the hot weather the air would be much less dense on the surface than in the mine. Also in the above figure (1) the pressure at T is less than the pressure at C owing to the fact that the temperature of the shaft $S\,C$ is lower in the summer than the outside air, and the air in it would consequently be denser, and the extra pressure at C would be equal to the difference in weights between the column in the shaft $S\,C$ and a similar column outside. Considering the same thing in winter we find that the opposite would be true, for now the air in the shaft $S\,C$ would

be very little cooler than in summer, while the corresponding column outside would probably be below freezing, this would cause a greater pressure at *T* and so cause the air to flow in the opposite direction.

The management noticed that the air was always good close to the steam pipes leading to the pumps and was led to try the well known expedient of steam jet ventilation. A 2 in. pipe was led from the boilers of the hoisting engines almost to the bottom of the mine and from the end of this a 1 in. pipe carried the steam to the bottom of each shaft. By pointing the ends of the pipes upwards and turning on the steam at considerable pressure, the air is forced by an injector-like action in the direction of the jet and as the steam and pipes as well heat the air considerably, this aids in helping it to rise. During the first fifteen minutes that the steam was led down, nothing but water escaped, and after that the steam came freely, and at the end of two hours the shafts and adjacent stopes were filled with steam for about one-third of the distance up. As soon as the steam was shut off it quickly

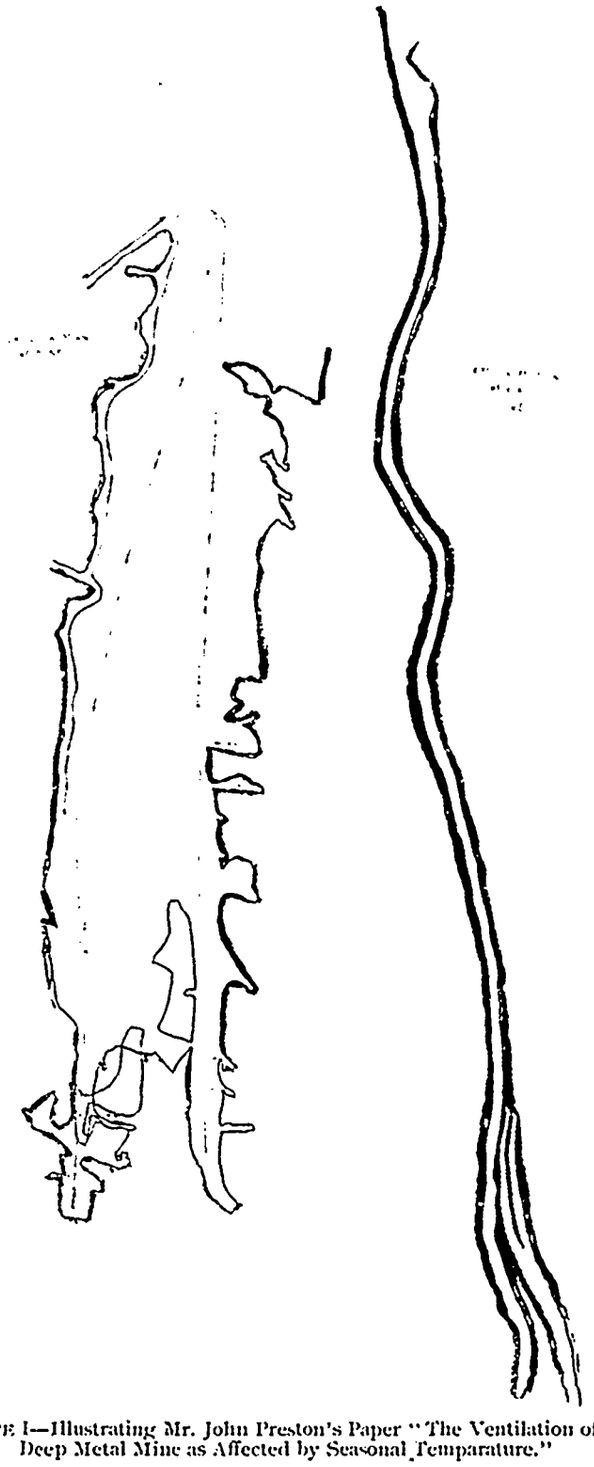


PLATE I—Illustrating Mr. John Preston's Paper "The Ventilation of a Deep Metal Mine as Affected by Seasonal Temparature."

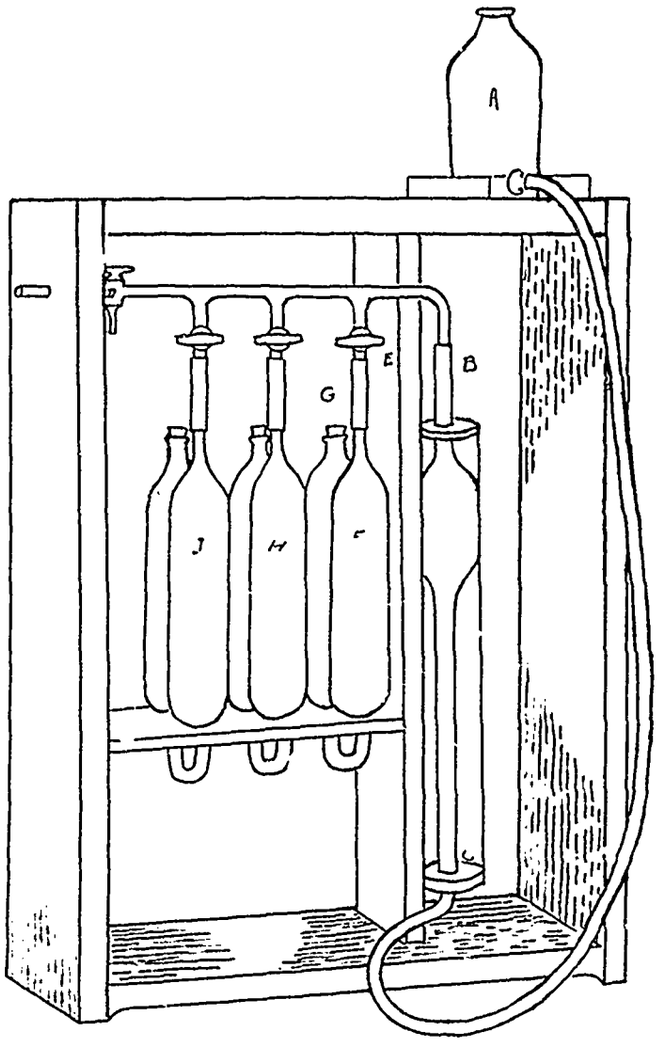


PLATE II—Gas Testing Apparatus, illustrating Mr. John Preston's Paper "The Ventilation of Deep Metal Mine as Affected by Seasonal Temperature."

condensed and fresh air took its place and the current once established kept on circulating for a number of hours. This proved quite effective and was found that the use of steam for two hours a day was ample And at a time when the boilers are not otherwise in use the method is to be commended as probably the most satisfactory, whereas in this mine the need of artifical ventilation is so occasional as not to justify the installation of a regular ventilating plant. In order to see just what change took place in the air it was necessary to make a series of analysis and tests of the air from different parts of the mine during the month in which the ventilation began to be very unsatisfactory knowing that there was no especially poisonous gas, and that the trouble was due to a lack of oxygen and a corresponding excess of carbonic acid gas the testing apparatus here figured was employed. Its construction will be readily understood from the drawing and the following description of its use:

It consists essentially of a measuring burette graduated in cubic centimeters, which has at the upper end a heavy capillary glass tube through which the sample of air is brought. At the end of this tube there is a three-way tap and between this and the burette are placed three "U" tubes, each controlled by a tap in the main tube. To the lower end of the measuring tube there is connected, by means of rubber tubing, a bottle containing water which is used for driving all the air out of the measuring burette and capellany tube before the experiment and for keeping the sample under a definite pressure during measurement, as explained hereafter. The determination for carbonic acid is effected as follows: The bottle of water *A* is placed as

represented in the figure and the three way tap *D* is turned so that the air in the measuring burette passes out through the bottom of the tap and is replaced by water. The tap *D* is then closed, the bottle *A* lowered, and the tap *D* turned so as to connect the sample of air to be tested with the apparatus. Exactly 100 c. c of the sample is admitted to the burette, the tap *D* closed and the bottle *A* raised to its former position The tap *E* is then opened, admitting the sample to the bulb *F* which is filled with a solution of pure caustic soda of 1.115 to 1 16 Sp. Gr. which rises in the other limb of the U tube as the sample enters. The caustic soda is repeatedly lowered and raised in *F* by means of a pressure bulb applied at *G*, and the sample is then returned to the burette for measurement.

The whole operation is then repeated until the volume of the sample remains constant. The difference between this residual volume and the original 100 c. c. represents the amount of carbonic acid in the sample. The quantity of oxygen is found in a similar way by passing the sample from which the carbonic acid has been extracted as above, into the bulb *H* which contains alkaline pyrogallate prepared as follows:

One hundred grains of caustic potash is dissolved in 500 c. c. of water and 40 grains of pyrogallic acid in 500 c. c. of water, and when using two parts by volume of the caustic potash is mined with one part by volume of the acid and put in the other tube.

After carefully noting the amount of air that is left in the burette after the first test the air is passed as before through this solution, the difference in volume giving the percentage of oxygen.

In testing for moisture a fresh sample of the air is employed and it is treated in the bulb *J*.

Had it been possible to obtain mercury to use in the bottle *A* instead of water, determinations of moisture might have been effected by filling with strong sulphuric acid and into it introducing the sample.

On June 6th a test of the air from the surface gave: oxygen, 19.7 p.c.; carbonic acid, 0.0 p. c.; while a sample from under ground gave: oxygen, 18.8 p. c.; carbonic acid, 0.2 p. c.

The following is a tabulated list of the results of the analysis of air taken from the different parts of the mine. It will be noticed that the amount of carbonic acid greatly increased as the season advanced, and while systematic temperature determinations were not made, a general correspondence between the few taken and the air analysis is evident:

Date.	Locality.	Per Cent. C. O.²	Per Cent. Oxygen.
July 2	Johnston's Stope	0.6	17.9
3	Slide Drift	0.4	18.0
4	Moyle's Drift	0.6	18.0
7	Jones' Drift	0.9	17.8
8	Nelson's Drift	1.0	17.3
9	No. 3 Shaft	0.8	17.8
10	Near Turntable	0.9	17.9
13	Old Drift (not working)	1.6	17.3
14	Jones' Drift	1.6	17.4
16	Beattie's Drift	0.6	18.0
19	Dire Drift	1.8	17.0
20	Halfway down ladders	2.8	16.9
22	Harvey's Drift	0.9	17.1
23	Moyle's Drift	1.1	16.3
26	Jones' Drift	1.2	16.8
29	Billadeau Stope	1.6	16.9
29	Turntable	0.4	17.8

Temperature determinations were taken on June 7th and August 8th and were as follows:

	June 7th.	August, 2nd.
At the Landing	66.0	66.6
Bridge		57.8
Slide Drift	54.8	56.0
Dire Platt		57.0
Turntable	55.0	56.2
Junction	55.2	56.5

These were all taken in the air, not close to the walls. This shows that in two months the average temperature in the mine has risen about 0.2°, and that there has been a gradual increase in the amount of carbon dioxide and a decrease in the amount of oxygen in the underground air.

Just what chemical effect the steam has on the air is rather uncertain. We know that at ordinary temperature and pressure, water will combine with an equal volume of carbonic acid, and, although at higher temperatures this decreases, there was no doubt some absorption of carbonic acid by the steam.

Notes on the Moebins Processes for Parting Gold and Silver, as carried on at the Guggenheim Smelting Works at Perth Amboy, N.J.

(By Percy Butler, McGill College, Montreal).

The term Electro-Metallurgy, originally applied by Alfred Smee to the art of electro-deposition or virtually electroplating of metals, is now more correctly used to cover the various operations of the metallurgical treatment of ores and the refining of metals by electricity. During the last twenty years its practical development, which had been the dream and hope of the early electrician, has gradually but surely grown into an industry of no small magnitude, and the great improvements which have been made in dynamo-electric machines within a comparatively recent period have given a stimulus to work in this field of enterprise which will, no doubt, make it of immense scientific and considerable commercial importance in the near future.

Mr. J. B. Elkington was the first to practically demonstrate the value of electro-metallurgy in the modern sense, by introducing in the year 1865 a practical process for refining copper. Since that time many new ideas developed, through years of experience, have brought this copper process to a state bordering on perfection. The electro-metallurgy of the precious metals did not, however, develop so rapidly, and gold and silver were not successfully "parted" on a large scale by means of electricity until the year 1884, when Moebins of New York invented the process named after him, which process is still in successful use. Eleven years afterwards, or in 1895, he developed a modified method which is now called his Improved Process.

As I had the unusual privilege of spending the past summer in one of the largest and most successful of the modern electrolytic works on the continent, I have thought it advisable to offer a few notes on the methods there in vogue and to describe in some detail both forms of the Moebins Process for parting gold and silver, which are very successfully carried on there side by side.

The firm of M. Guggenheim's Sons of New York is one of the most important factors in the metallurgical market of the United States. They own mines and smelting works in Mexico and Colorado which ship their concentrated output in the shape of copper matte and base bullion to a large central refinery which, situated on tidal water in New York Bay, and with every opportunity to secure scientific and skilled superintendence and labor, is able to treat them most successfully and economically.

The size of this establishment which, although only three years old, is already being enlarged, may be estimated from the fact that it is said to have refined over $50,000,000 worth of metal in 1896!

The plant (plate 1) occupies about 100 acres on the Arthur Kill, and has excellent deep-water docks as well as connections with several main lines of railway, and is thus enabled to receive its raw material and coal with the least possible loss and expense in handling. As the establishment is designed to treat all of the products of its feeders, the work is divided into several main lines, which may be said briefly to consist of (1) copper refining by electricity, (2) desilverzation of

base bullion by the Parke's Process, and (3) the parting of doré-silver by the Moebins Processes.

As the processes of the different parts of the establishment are closely dependent on one another, it will be necessary to give an outline of the whole system in order that our special subject, the Moebins Silver-Gold Process, may be fully understood, and as the method of copper electrolysis in use is similar and in many ways closely allied to the Moebins, I shall speak of it in more detail than will be given to non-electrolytic methods.

Before beginning the description of the plant it may be well to explain that several of the most important electro-methods in use in metallurgy depend upon the fact that certain solutions — usually acid — which, under ordinary circumstances have actually but slight power of dissolving metals, have this power greatly increased if a strong current of electricity is passed from the metal into the solution, and that the metal so dissolved is precipitated on plates of good conducting material at the point where the current exits from the solution.

The Copper Plant.—The copper plant consists of two large buildings known respectively as the Foundry and Tank House.

Foundry.— In the foundry there are three large brick reverberatory furnaces — one for concentrating the copper matte received from the blast furnace and converting it into black copper, one for making anodes of black copper and one for converting the cathode copper into marketable form. As the black copper arrives at the foundry in the form of pigs from Mexico and Colorado, they are first sampled by boring holes at intervals through each bar by means of an electric drill, and then cast into rectangular plates called anodes, which are taken by means of a narrow gage railway to the tank house, where they are electrolytically refined.

Tank House.—The tank house contains 180 double tanks, each divided longitudiually in the centre by a partition into two compartments about 12 ft. x 2¼ ft., and 3½ ft. deep. The tanks are made of wood strongly bolted together externally and lined inside with heavy sheet lead. (Plate 2). They are arranged in 12 rows separated by

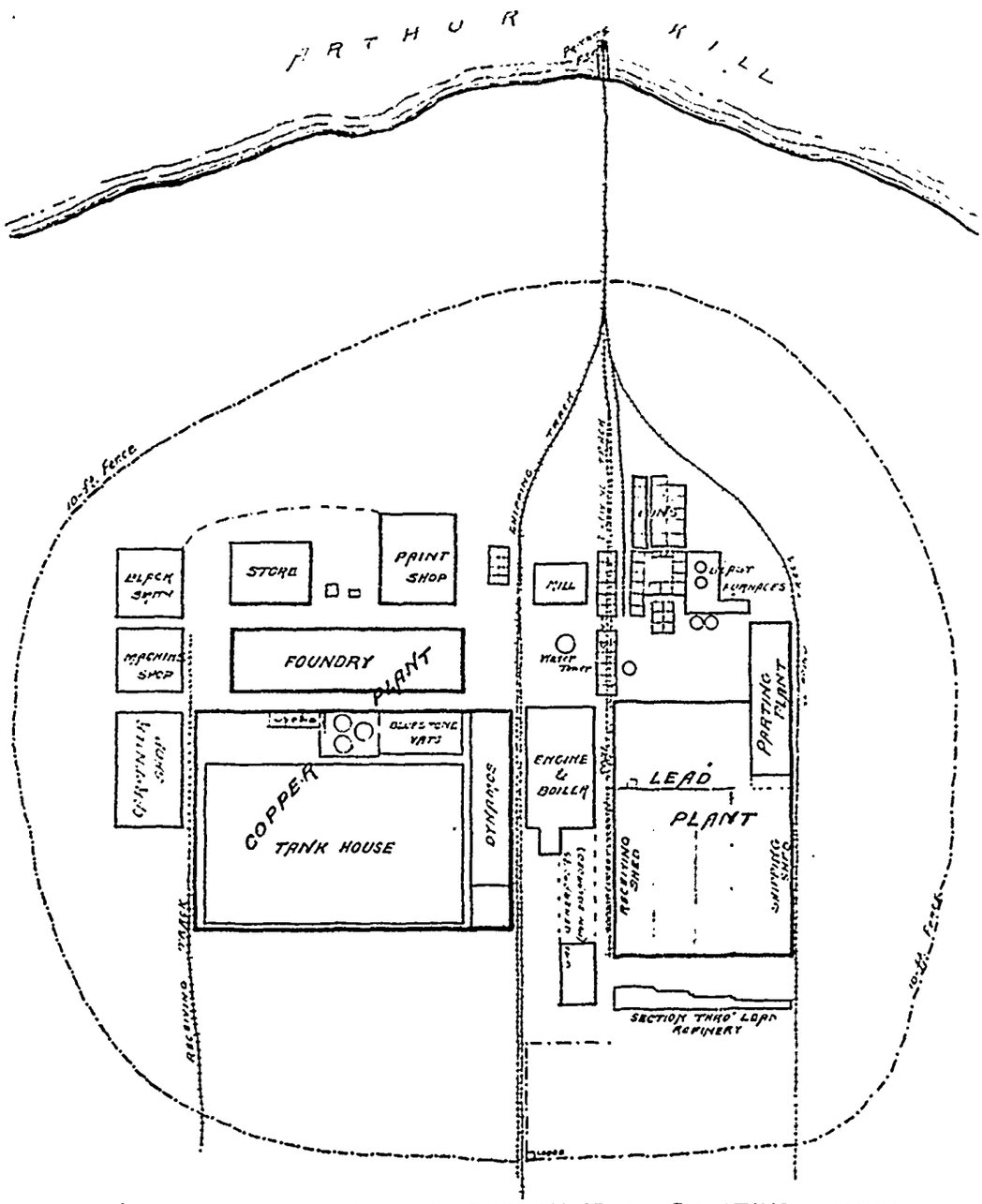


PLATE 1. GENERAL PLAN OF GUGGENHEIM SMELTING WORKS LOCATED AT PERTH AMBOY, N. J.

P BUTLER (Del)

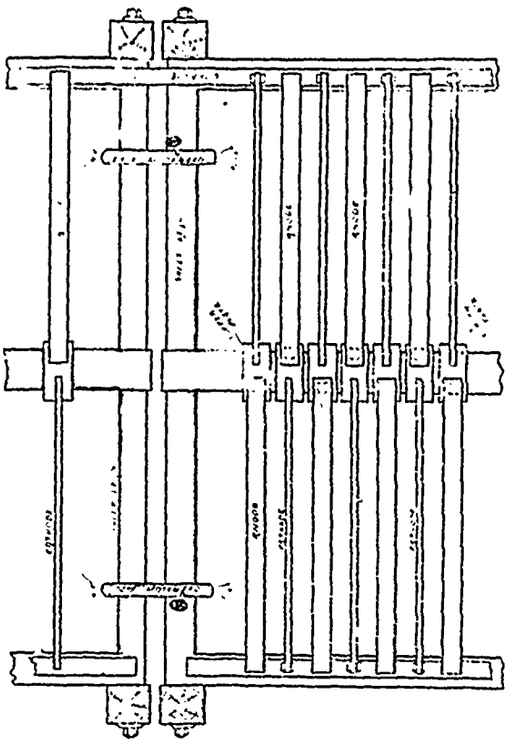


PLATE 2. PLAN OF TANK SHOWING ANY TWO OF THEM ARE CONNECTED BY LEAD PIPES AND COPPER RODS.

P. BUTLER (del.)

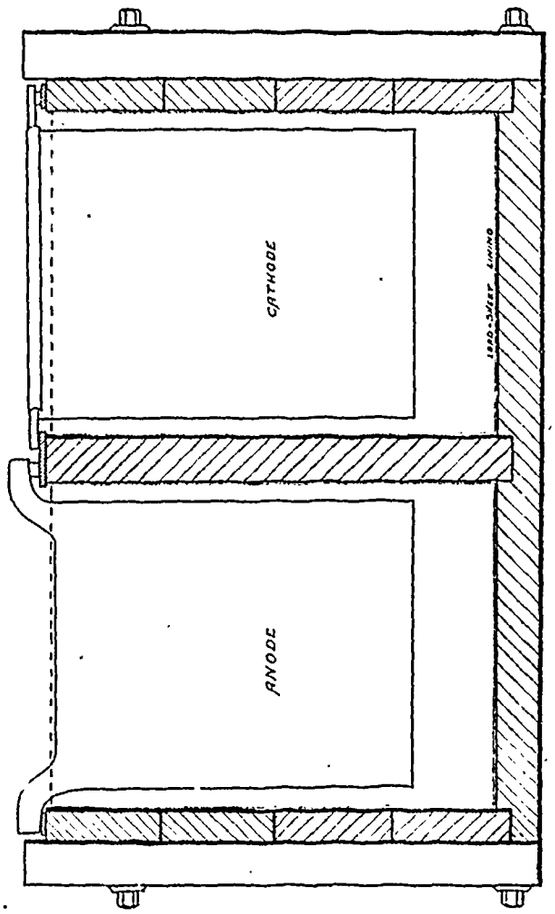
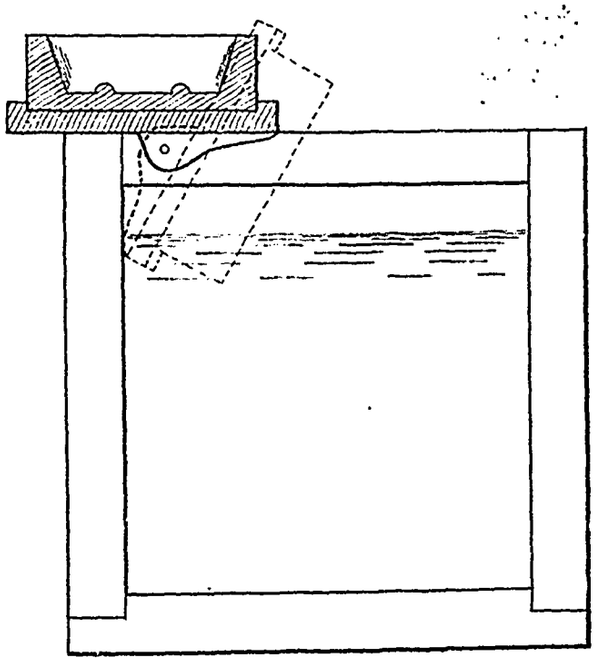
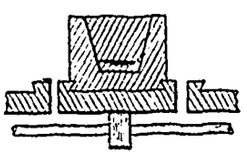


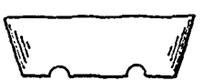
PLATE 3. CROSS SECTION OF COPPER TANK SHOWING MANNER OF SUSPENDING ELECTRODES.



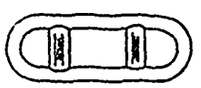
LONGITUDINAL SECTION OF MOULD



CROSS SECTION OF MOULD



SIDE OF INGOT



BOTTOM OF INGOT

PLATE 4.

P. BUTLER (del.)

narrow aisles. The tanks in each row are terraced and connected by lead overflow-pipes controlled by faucets so that circulation of the electrolyte goes on through gravity. The last tank of each row empties into a lead-lined trough connected with the storage tank, by means of these arrangements the tanks can easily be emptied for the purpose of cleaning up slimes and re-standardizing the electrolyte.

Along the top on either side of the tank run copper connecting rods on which rests one terminal end of the electrodes; the other end rests on copper plates placed along the top of the dividing wall between the two compartments; the alternate ends of the electrodes being insulated by means of porcelain blocks (Plate 2).

Electrodes.—The electrodes in each compartment consists of 22 anodes and 22 cathodes suspended alternately about 1½ inches apart and wholly immersed in the blue-stone solution. The anodes (Plate 3) are about 2 ft. x 2¾ ft. and 2 in. thick and weigh approximately 200 lbs. The cathodes have the same surface area as the anodes, and are prepared in what is called the graphiting department by precipitating copper on thin sheets in tanks, 15 in number, set apart for that purpose.

The electrolyte, which is a beautiful blue colored solution, contains between 6.0 p. c. and 7.0 p. c. H_2SO_4 and is supplied to the tanks from a central distributing reservoir placed overhead, to which the solution, after being heated, is pumped from the storage tank. This solution is tested daily and more or less acid and bluestone are added to maintain it at uniform strength; in course of time the electrolyte becomes charged with impurities taken up from the dissolved anodes and has to be renewed, the foul solution being diverted into large lead-lined vats, where either the bluestone is crystallized out on strips of lead hung in the solution or else the copper is precipitated by scrap iron, the remaining solution in each case being thrown away.

The electric current which goes through in 'multiple' circuit varies between 2,200 and 2,400 ampères, delivered at about 250 volts, the current and fall of potential being registered by large ammeters and voltmeters, which, placed in the dynamo room are read every hour and noted, together with the number of tanks in circuit. In order to lessen the resistance the connecting rods and plates are cleaned daily with emery cloth, and to prevent in any of the tanks short-circuiting, detected by means of a portable voltmeter, the cathodes are lifted out and the irregular lumps or growths of copper are removed.

By the compound action of the acid and electricity the anodes become disintegrated, the copper being precipitated on the cathodes, while the precious metals fall with the impurities to the bottom of the tank in the form of slime, and have to be replaced The cathode sheets remain in the solution for about 16 days, those from eight double tanks being replaced daily; the anodes last from four to five weeks, depending on the strength of the electrolyte. Every day 10 tanks are cleaned, and the slime, containing gold, silver, copper and impurities, such as arsenic, etc., is taken from the bottom and the copper leached out; it is then washed, dried in small ovens and shipped in paper bags to the cupel furnaces of the lead refinery.

Above each row of tanks there is an overhead crawl running on a double track and having a snatch block and fall on its under side by means of which the tanks can more easily be loaded and unloaded.

The cathodes, as they are removed from the tanks, are taken to the foundry, where they are melted and cast into ingots weighing 18 lbs., and wire-bars weighing 175 lbs., ready for shipment.

In order to prevent the copper from oxidizing and to secure a smooth surface to the castings, the molten copper is 'poled' just before being ladled — the eye-taught only by experience — being able to judge the necessary amount of this poling.

In front of the refining furnace are situated several water boshes, on the sides of which are fixed the moulds, as shown in Plate 4; as soon as the ingots have solidified the moulds are dumped into the water, and by this means the casting is colored a deep rose-red, the shade most liked for the market. The moulds do not last long and have soon to be replaced by new ones, which are made of copper in the refinery by means of a stamp.

The Lead Plant.—The lead plant consists of a huge structure built, as most modern smelters now are, in terrace-form, in order to facilitate the handling of the furnace products.

The base bullion which is desilverized and refined by what is known as the Parke's Process, is received at one side of the building, and after passing through the various furnaces arrives at the other side ready for shipment. The bars of base bullion are sampled on the car by driving a cylindrical punch having a hole ¼ in. square in the end, half way through the bars. The position of the punch in each bar is changed both as to length and width of the bars; the bars are then turned upside down and punched again in a similar way so that one sample chip is obtained from the top and one from the bottom of each bar.

They are then charged into the softening furnaces in 60 ton lots. The operation of charging is performed by two men, one of whom lifts the bars on to the blade of a long-handled paddle which the other manipulates, using the bottom of the furnace door as a fulcrum.

The softening furnaces, or 'softeners,' as they are called, are large water-jacketted reverberatory furnaces. They serve to get rid of most of the arsenic and antimony which rise to the surface of the molten bullion and are removed by means of a perforated scoop and sent down to the blast furnace as "autimony skimmings." Through a discharge-spout at the flue end of the furnace the molten bullion runs into the desilverizing kettles located on a lower level.

Threse kettles, which are large cast iron bowls embedded in the floor and heated underneath by furnaces, are used to separate the precious metals from the lead. This is done by what is known as the Parke's Process, which is based on the fact that silver and gold have great affinity for zinc when all are in the molten condition, and will combine with it to form an alloy which is lighter than lead and does not dissolve into it.

The operation is as follows:— Zinc is added in three separate portions and intimately mixed with the bullion by means of a mechanical stirrer. In the first two 'zincings'—as the additions of zinc are called—not quite zinc is added in order to have the zinc saturated with the precious metals, whilst in the third zincing the product of which forms the first zincing of the next charge, a larger quantity is added than necessary so that no silver etc., may remain. After each successive addition of zinc the temperature is lowered and the zincings—in the form of skimmings—are transferred by means of perforated scoups from the surface of the molten lead to a perforated iron box, called a skimmer.

The skimmer (Plate 5) is cylindar shaped and consists of an air-tight chamber, *A*, rigidly connected to a perforated box, *B*. Between the chamber, *A*, and the box, *B*, is a sliding cover, *c*, which fits into the box, *B*. This cover is attached to *A*, in such a way that when steam under a pressure of 65-85 lbs. to the square inch is introduced into the chamber *A*, through a pipe *S*, the cover is forced down compressing the contents of the skimming-box This skimmer is raised and lowered by means of an overhead electrical travelling crane which can be used for any of the four desilverizing kettles.

The desilverized lead is then siphoned off into another furnace, where it is further refined to free it from traces of excess of zinc; and from this it is tapped into a sump. Here, the lead remains for a short while and is finally siphoned off into moulds and when cast is ready for shipment.

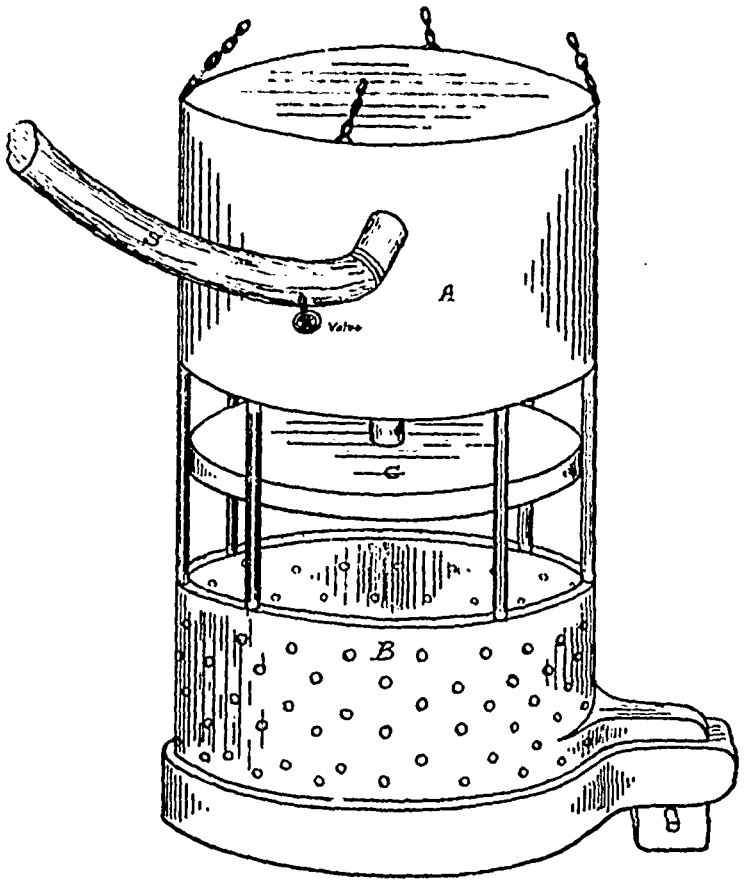


PLATE 5.- SKIMMING - BOX.

P.BUTLER (del.)

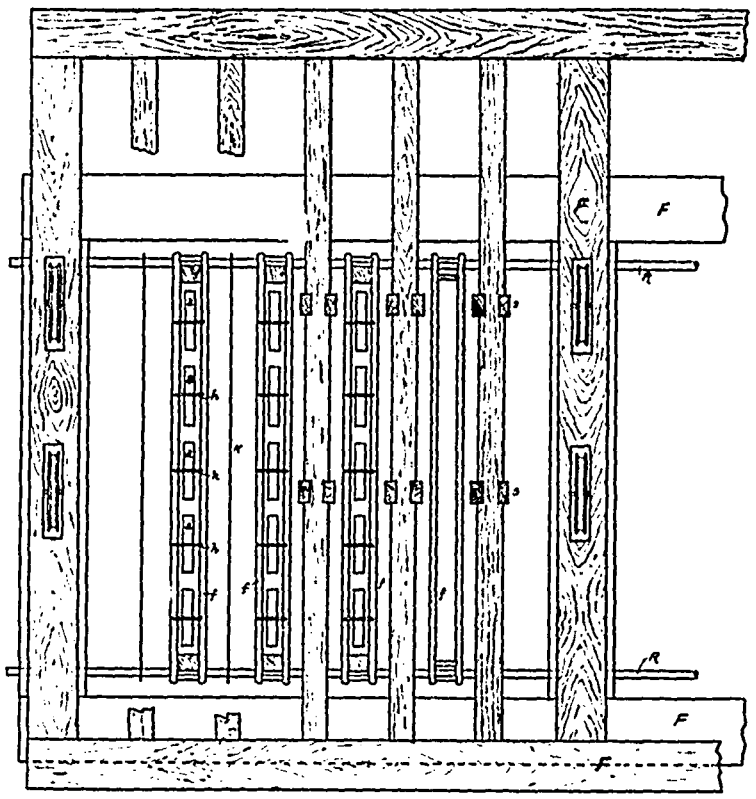


PLATE 6. PLAN OF TANK-CELL.

P.BUTLER (del.)

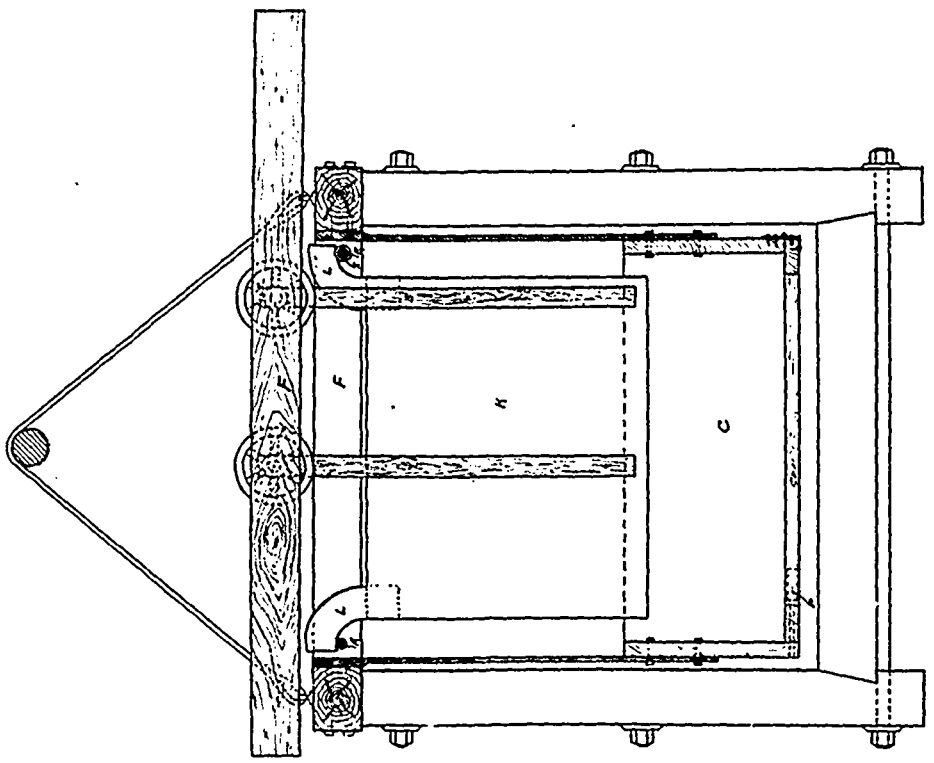


PLATE 7. CROSS-SECTION OF TANK-CELL SHOWING CATHODE.

P.BUTLER (del.)

The zincings are taken to a hopper through which they descend to the ground floor where they are heated in Faber du Faur retort furnaces. These retorts serve to volatilize and condense the zinc leaving the doré-silver which are then heated in concentrators—which are practically water jacketted English cupel furnaces with cement hearths—and finally cupelled and cast into moulds of proper size and shape for anodes which are taken to the Parting Plant ready for the Moebins Process proper.

The Parting Plant.—This parting plant is located in the same building as the lead refining, but recently an extension has been added to meet the growth of business and on account of the large quantity of precious metals handled it is kept cut off from the rest of the establishment. The building, which is made of brick roofed in with sheet iron, is about 35 feet wide and 150 feet long; the floor, except in the melting room where it is made of iron flags, consists of 1½-inch planks resting on masonry foundations and covered with ½-inch asphalt laid hot and rolled evenly. Here, the anodes as they arrive from the lead plant are first weighed and then 'parted' by what is known as the Moebins Process.

(i) *Moebins Process Proper:*—

This consists, commonly speaking, of immersing the anodes—enclosed in canvas bags—in a weak solution of nitric acid through which a current of electricity is passed; the silver dissolves and as the anodes become disintegrated the gold falls to the bottom of the bags whilst the silver, passing through in solution, is deposited on thin silver sheets placed outside which take the place of the cathodes of the copper plant.

Tanks.—The tanks are ten in number and are made of 3-inch pine so bolted together that they admit of tightening to render them water-tight and are divided into six cells These cells which are about 2 feet square and 2 feet deep, are lined inside with canvass and thickly coated all over with an acid-proof paint. On the top of each tank rests a compound frame-work which can be raised or lowered by means of a windlass.

Frame Work.—The frame-work (marked *F* figs. 6, 7, 8, 9) consists of two wooden frames—one resting on top of the other; to the lower which is stationary are attached two connecting rods, *R*, which support the electrodes underneath which hang the collecting boxes—one for each cell—also rigidly attached to the lower frame; the upper frame, which moves on wheels across the lower by means of an eccentric, has attached to it strips of wood (*S* plate 9), which hang down—two on either side of each cathode—into the electrolyte and act as scrapers to keep the deposit on the cathodes of uniform thickness.

Electrodes.—In each cell there are 25 electrodes, consisting of 5 cathodes suspended alternately with 4 canvas bags in each of which are 5 anodes. The cathodes, (*K* plate 9) which are about 18″ × 15″ are made of thin sheets of pure silver to the two upper corners of which are attached curved lips, (*L* plate 7) which rest on the copper rods, *R*. These sheets before being immersed in the electrolyte are painted and coated with graphite to prevent the silver deposit from adhering too strongly to them. The anodes (*a*, plate 8) are, as stated before, made of doré-silver about 3″ × 12″ and ½″ thick, and enclosed by canvas bags, (*B* plate 8) are suspended by means of platinum spring hooks, *h*, resting on copper frames, (plate 6 *f*) which in turn are supported by the copper rods *R*. The canvas bags are simply wooden frames about 20″ long by 1″ wide and 15″ deep, over which is stretched canvas cloth; these bags fit inside the copper frames (*f* plate 6) one end of which is insulated by rubber from the connecting-rods The connecting rods, (*R* plates 6, 8, 9) are about ½″ in diameter and run the whole length of the tank connecting the six cells in 'series' circuit. Plate 7 shows one lip of the cathode resting on rubber insulator, marked *I*.

Electrolyte.—The solution—known as the electrolyte is prepared in vats situated under the floor and is pumped up to distributing reservoirs placed overhead from which the tank cells are supplied through a rubber hose with porcelain stop-cock. It is made by dissolving granulated silver in a weak solution of nitric acid (1:30) and after further dilution copper is added to start the deposition. When normal it contains about 0 13 per cent. of free acid with 4 to 5 per cent. of copper and about 12 ozs. of silver per cubic ft. of electrolyte.

Electric Current—The strength of the electric current varies between 200 and 240 ampères depending on the number of tanks in circuit and the strength of the solution; whilst the electromotive force required for each cell varies between 1·25 and 1·6 volts.

Mode of Procedure.—The cathodes are scraped once every day and the deposited silver removed to the melting room; this is done as follows:—The tank is disconnected and the whole of the frame-work together with the electrodes and collecting-boxes is lifted clear out of the solution; the cathodes are then 'stripped' by means of a pair of silver-tipped tongs—the deposited silver falling into the collecting-boxes These boxes are about 22″ square and 10″ deep, made of ¾″ pine and provided with a hinged grid-bottom covered over with canvas to allow the solution to drain off but which retains the silver. The frames are then raised about 2′ higher and the pin which holds the grid-bottom in place is knocked out when the bottom falls depositing its load of silver into a wooden tray previously placed underneath. As soon as all the cells have been relieved of their silver which is sent to the melting room, the frames are lowered and the tanks connected up again.

The gold, which is retained in the canvas bags in the form of a dark slime, is washed in three different waters and sent to the gold room to be refined.

(ii.) The Improved Moebins Process which, as its name implies, is only a modification of the former process makes use of a silver belt as an anode instead of silver sheets. Before I left they were using this in 12 tanks and were engaged in putting up 60 new tanks to be used in this process.

The tanks are arranged in twelve sections separated by 4′ aisles and each section consists of six tanks, arrayed in 3 tiers, 15″ apart; three iron cross-pieces rigidly attached to pillars and extending on either side of them form supports for each pair of tanks. The distance from the floor to the top of the uttermost tank is 5 feet 6 inches. The tanks themselves are made of one piece of pine wood 14 feet 3 inches long, 16 inches wide and 7 inches high, gougeed out in the centre and lined inside with canvas cloth and coated all over with an acid-proof paint.

In each tank there are 24 frames—known as diaphragms—about 18″ × 4″ and 1½″ deep, whose bottom consists of canvas, and in this an anode is placed resting on hickory supports. Running underneath and within ½″ of the frame bottoms is a belt 31′ × 15″ made of rolled sheet silver 1·32″ thick, on the outer surface of which the silver is deposited; to keep the silver from depositing on both sides of the belt the inner surface (of the belt) is automatically oiled.

The belt runs over a roller placed at either end and by means of a series of cog-wheels one of these rollers is connected to a belt run by electric power received from a generator capable of delivering 300 ampères at 150 volts whose power is supplied by a 40 H. P. Westinghouse engine.

Electrolyte.—The electrylyte is the same as that used in the other process, and is supplied to the top tanks from which by means of overflow pipes across and down the rest of the tanks are supplied; the lowest tanks of all emptying into the collecting reservoir.

Electric Current.—Copper rods run along the top on either side of the tank and connect the tanks "in series" circuit. Contact is made with the anodes by means of platinum-tipped contact levers, and the belt is put in circuit by means of silver contact brushes.

Mode of Procedure:—

The fine crystals deposited on the belt whilst moving at the rate of three feet per minute through the solution are seraped off automatically

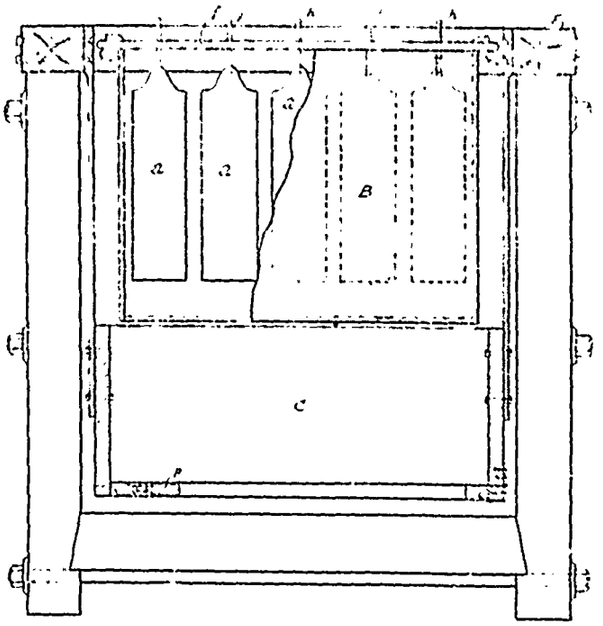


PLATE 8. CROSS-SECTION OF TANK-CELL SHOWING CANVAS BAG CONTRAINING THE ANODES

PBUTLER (del.)

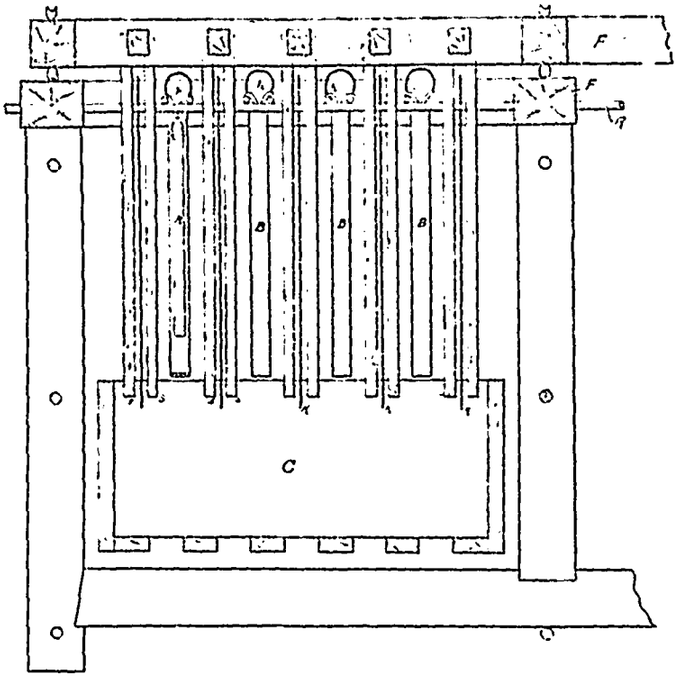


PLATE 9. LONGITUDINAL SECTION OF TANK-CELL.

PBUTLER (del.)

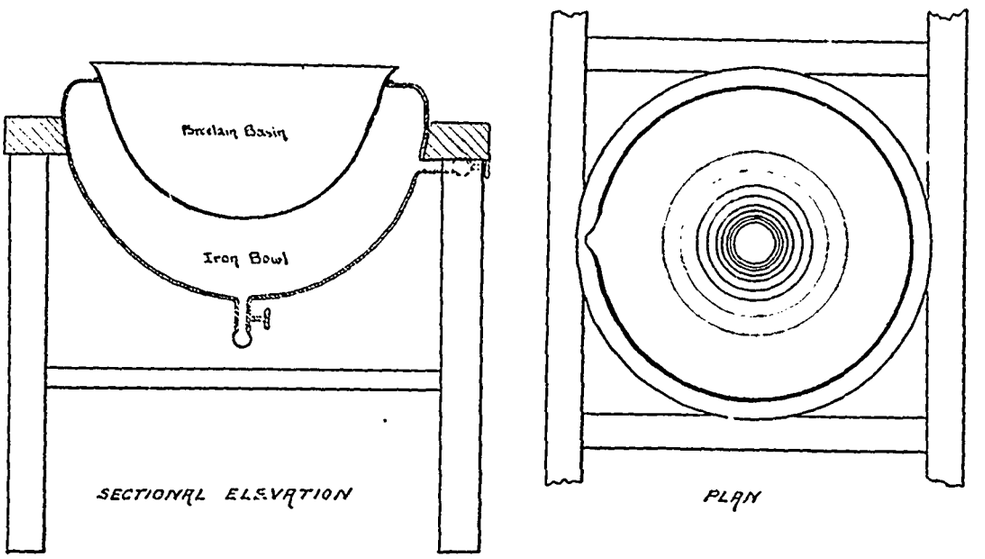


PLATE 10. PORCELAIN BATHS USED IN GOLD-ROOM.

PBUTLER (del.)

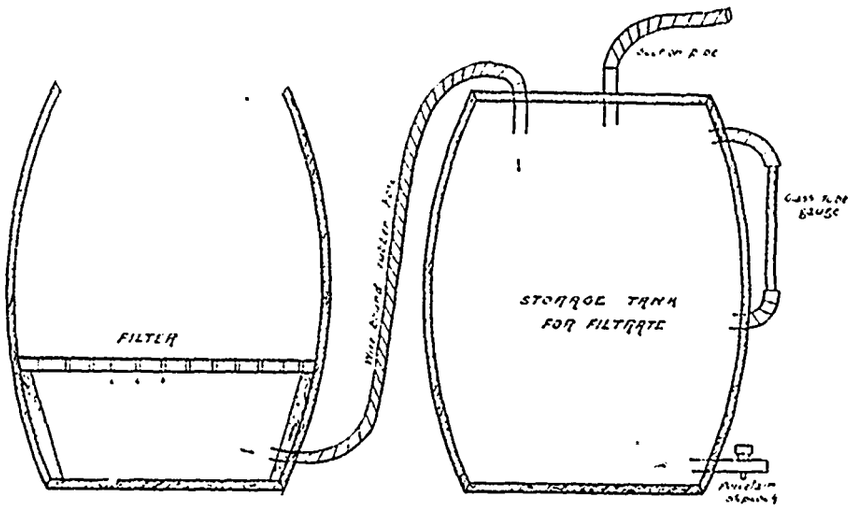


PLATE 11. APPARATUS FOR FILTERING SILVER-NITRATE

P.BUTLER (DEL.)

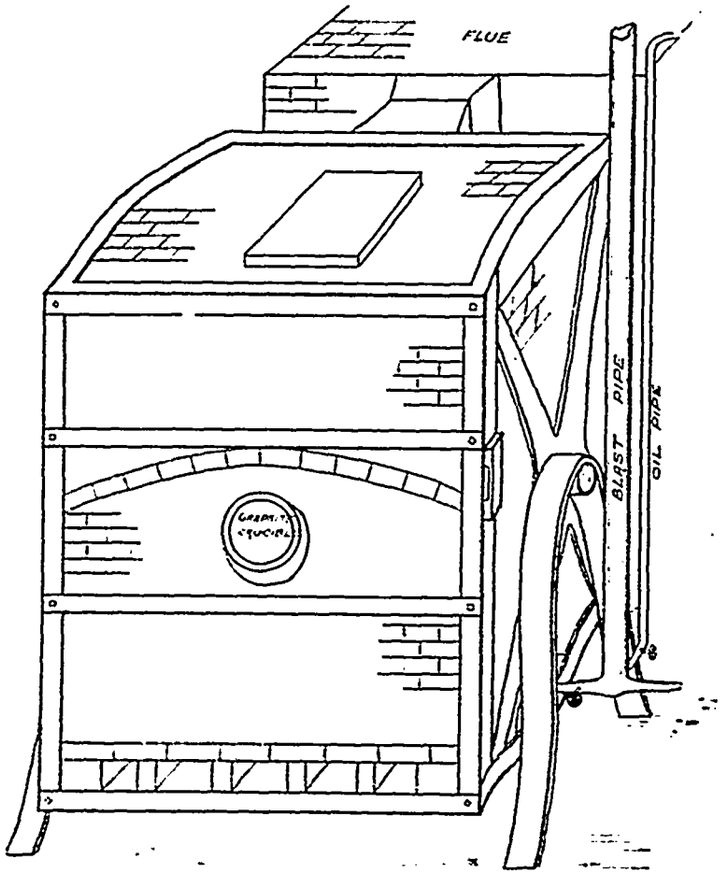


PLATE 12. SILVER REFINING FURNACE

P.BUTLER (DEL.)

by brushes which, made of thin rush-wood, are fixed in closed boxes placed at one end of the tank. The silver drops into these boxes which are removed and cleaned at intervals, the silver going direct to the melting room. The gold which is left in the diaphragms, is washed and then taken to the gold room for wet treatment.

Gold Room.—Here, all the gold slimes are treated with nitric acid in large porcelain bowls heated by steam (plate 10); after several days treatment it is taken to the melting room, and in the form of a heavy chocolate colored mud is melted in a small furnace, borax being used as a flux. The refined gold thus produced is cast into the form of a brick, three—and sometimes four—of which are obtained weekly: the largest turned out whilst I was there weighed 465.5 ounces of 908.5 fine.

The nitric acid used in the gold treatment is ladled into large porcelain jars and allowed to settle: it is then taken to barrels and the silver in solution precipitated by means of common salt, the reaction being represented thus:—

$$Ag\,NO_3 + Na\,Cl = Ag\,Cl + Na\,NO_3.$$

The precipitate (Ag Cl) is filtered by air suction, dried on the furnace flues and sent to the concentrators of the lead plant (plate 11).

Melting Room.—The silver removed from the tanks—of either process—is brought to the melting room where it is melted in large retort furnaces. These furnaces (plate 12) are made of fire-brick built into an iron frame supported on trunnions, and which, for the purpose of pouring are capable of being tilted by means of a lever. The heat is obtained by oil fuel burned with a blast. The retort which is made of a compound of which graphite is the predominant ingredient lasts long enough to refine about five tons of silver.

The silver is cast into bricks weighing from 1,000 to 1,175 ounces each: and a smooth surface is obtained by burning a little sugar on the molten surface of the casting and covering for a short while.

It is not within the scope of this paper to discuss the respective merits of the two processes just described, but I may say that on account of so much oil being used on the belts the silver deposited by the Improved Process was quite saturated with it and—though thoroughly washed—on being refined destroyed the graphite crucibles more rapidly than the silver from the sheets.

In conclusion, the plant has a daily output of from 24,000, to 28,000 ounces of silver varying in fineness from 940 to 990; but the additions in progress at the time of my leaving are expected to raise the output to three tons of silver per day.

Kettle River Valley Railway.

In the discussion of this railway project it appears to us that two errors have been made by those who are opposing the passage of the Bill.

In the first place it has been assumed that the condition of trade relations which surrounded the opening up of the Kootenay district in British Columbia, and which were due to accident, will continue now that the reason has entirely vanished. It is well known that the Trail Creek Mining District of British Columbia was opened up almost entirely by prospectors and miners from Idaho and Montana. These people had for many years been dealing in the City of Spokane. They were acquainted with the merchants there, and knew that large stocks of mining supplies were held in that city. They had actually no knowledge of Canadian cities, or the trade which could be done in them. Even if they had been acquainted with the route by which goods could be shipped, and with what persons they could safely deal in Montreal, Toronto, or other eastern Canadian cities, or even with Victoria or Vancouver, miners in Kootenay would, at that time, have found it very difficult to supply their wants in Canada. Our merchants and manufacturers were not then in the position which they are to day with reference to mining; their stocks carried but a limited supply of miners' goods, and many things which were required were not to be had at all in Canada. But this was an accidental circumstance. It did not take our people long to see that, with the protection which the duty afforded them, they could enter the field and compete with the American merchants at Spokane, and the manufactures of mining machinery generally in the United States, notwithstanding the fact that Canadian merchants and manufacturers were situated at a much greater distance from the field of operation than many of the Americans.

It appears to us to have been sufficiently proved that from 80 to 90 per cent. of the trade which is now being done in the Kootenay country is in Canadian goods.

When it is remembered that this condition of things has been developed by our merchants and manufacturers within the last two years, and that the rate of duty is such as to encourage our people, and work adversely to the United States, it seems to be an inevitable result that the percentage of trade must daily increase in favor of Canada, as against the United States.

In any event this is a question to be determined by reference to the trade policy of the country as a whole; it does not arise when a discussion takes place as to the advisability of allowing competing lines to enter a portion of our Canadian territory. It is surely absurd to raise the cry of "pandering to American interests," when the direct result of granting the Bill now before Parliament will be to open up a rich mining district to the competition of the Grand Trunk Railway, and when the effect of a refusal of the charter will be that a large and rich mining district in British Columbia will have no transportation company except the Canadian Pacific Railway.

Again, in discussing this question it has been assumed that the important matter to be considered is the smelting of the ores to be produced. It is without doubt of importance that the smelting industry should, if possible, be encouraged in British Columbia, but it is of far greater interest to the country generally that mining should be carried on under favorable conditions. The number of men employed in smelting is far less in proportion than those which are necessary for the development of mines.

Our merchants and manufacturers so far scarcely realise the large field which is open to them by the development of a number of low grade mines in any district. It may be safely assumed that the average miner will earn $1,000 in a year, and will spend $800 of that sum in the purchase of supplies and luxuries. It has been estimated that if the Boundary Creek District is opened up, in a few years Kootenay and the Boundary will together be producing not less than $25,000,000 of ore in a year, and that one-half of this amount will be credited to the Boundary country. The Boundary ores are known to average about $18 per ton in value, and if the estimate above given is within the range of probability, it is easy to understand what an enormous bulk of ore will have to be raised to produce a value of $12,000,000 in any year. Such being the prospect it certainly is of the greatest importance to the traders in Canada that mining in the Boundary country should be conducted under the most favorable conditions. It may be laid down as a self-evident fact that the most essential of all these conditions, is a cheap rate of freight transportation. We have no hope that that can be arrived at except through the agency of competing railways bidding for the trade.

With reference to the smelting proposition, it would seem that there is no reason for anticipating any difficulty whatever. Smelting is a business which it is always profitable to conduct in close proximity to the point of production of the ore, if the conditions of the country, and the character of the ore will permit. It seems absurd to argue that from any feeling of antipathy to Canada, or love for the United States, a business man will send his ore out of British Columbia for smelting, if he can make more money by having it reduced within the Province. The question of whether the smelting for the Boundary Creek District will be done in British Columbia or the United States, settles itself when the character of the ore and the natural conditions of the country are considered by anyone familiar with the business. It is admitted on all sides that in the neighborhood of the Boundary Creek Mines, water and timber are to be found in abundance, not only for mining but also for smelting purposes. The following assays which may be fairly taken as an average of the ore of that district show that they are self-fluxing:

(1) Average of samples taken from the Ironsides mines in Greenwood, made by the Bridgeport Copper Company:

Silver	3.58 ounces.
Gold	.33 "
Iron	46.47 per cent.
Copper	4.00 "
Lime	5.00 "
Sulphur	4.91 "
Manganese	Trace.
Silica	17.46 per cent.

(2) Assay of samples of the Great Hope mine in Deadwood Camp:—

Silver	2.64 ounces.
Gold	.26 "
Copper	3.00 per cent.
Iron	30.36 "
Lime	5.00 "
Silica	20.00 "

(3) Average of a mixed sample of five different lots of ore made on 4th March, 1898.

Silver	$ 1.55
Gold	$14.51
Iron	15.45 per cent.
Copper	4.10 "
Silica	34.53 "
Sulphur	3.97 "
Manganese	.82 "
Lime	14.70 "

Assay of another lot submitted with the five above mentioned.

Silver	$ 1.54
Gold	$ 6.82
Iron	17.28 per cent.
Copper	4.00 "
Silica	33.14 "
Sulphur	4.80 "
Manganese	.67 "
Lime	11.79 "

It is therefore obvious that in considering whether or not a smelter should be located in the Boundary Creek district, the only question to be determined is the transportation of coke and coal. At the present time coke for the Kootenay country as a rule is brought either from Puget Sound, or the coke ovens established by the Dunsmuirs at Comox, on Vancouver Island, B.C. The average price to points in Kootenay is in the neighbourhood of $10 per ton.

The promoters of the Kettle River Valley Railway, it is said, have undertaken that if their Bill is allowed, the price of coke at any point on their line in Boundary will not be more than $1 per ton in excess of the same product at Columbia River points. The rate of freight on ore from Boundary Creek to Columbia River points cannot at any time be less than $1 per ton. It takes but a moment's calculation on these figures, to show that there will be a tremendous saving in freight charges alone by smelting Boundary Creek ores in the District, instead of hauling them out to meet the coke at Columbia River points or Nelson.

A glance at the figures showing the value of the Boundary ores, and the prices paid by smelters, is an object lesson which in itself demonstrates that the smelting must be done within the district if the mines are to be developed at all. The prices paid by custom smelters are as follows:—

$1 for each per cent. of copper.
$19.50 per ounce for gold.
95 per cent. of the value of silver contents.

The Boundary Creek ore contains the following average values:

Copper, 4 per cent. or 80 pounds per ton at 11¼ cents	$ 9.00
Gold, 4.10 ounces at $20.67	8.26
Silver, 3.00 oz. at 55 cents	1.65
Total value one ton of ore	$18.91

The smelter buying this ore at present pays the following prices:

Copper, 4 per cent. at $1	$ 4.00
Gold, 4.10 oz. at $19.50	7.80
Silver, 3.00 oz., 95 per cent. of 55 cents	1.56½
Total value allowed by smelters	$13.36½

While this calculation demonstrates that the smelters at present have an advantage over the producer by $5.54½ per ton on the value of the ore, it also shows that there would be no margin at all for the miner, if the ore is carried any distance from the mine for smelting. For example taking the smelting value of the ore at 13.36½, the following result will be arrived at, if an attempt is made to ship it for treatment to Columbia River points. The cost of treatment is $7.50 and the freight rate say $1 per ton, the result is given below:—

Smelter value	$13.36½
Cost of freight and treatment	8.50
Balance for mine owner	$ 4.86½

But this sum of $4.86½ will barely cover the cost of mining and development, and will leave no profit at all on the transaction; therefore, those who argue that the Boundary Creek ores would be smelted at any other place than the point of production, are driven to contend that the mine owners of that country will work their properties as a whole at an actual loss, instead of a profit.

The position is summed up in a paper contributed to the proceedings of the recent Inter-Provincial Conference of Canadian Mining Engineers and published in the last issue of the REVIEW, by Mr. R. A. Hedley, Manager of the Hall Mine's smelter at Nelson, B.C., in the following words:

"Speaking of possibilities, however, I consider that they are far greater "in Boundary Creek District. There the variety is greater and a perfectly "self-fluxing ore is obtainable.... Once transportation is had development "will be pushed and plants will follow, ores will be treated both by direct "smelting for matte and by previous concentration.... Should the coal on "development prove to be of good coking quality, and in sufficient quantity "a plant with a large capacity will treat ore as cheaply as anywhere on the "continent. Even in bringing in coke at a cost of $12.00 per ton laid down, "I have no hesitation in saying that a 250 ton plant (two furnaces) using "steam power will smelt at a cost not to exceed $3.25 per ton."

With these facts established, it seems clear beyond question that the smelting of Boundary Creek ores must be done within the district. There can be nothing in the suggestion that the building of the Kettle River Valley Railway will be the means of taking ore out of British Columbia. It is not denied that it will cheapen the cost of every article necessary to be brought into the country for mining purposes

We have no quarrel with the C.P.R. nor are we champions of the Kettle River Valley Railway, but it is plain, upon the showing made by Sir William Van Horne himself, that he expects a higher rate of freight if the C.P.R. is allowed to control the country than if the Kettle River Valley Railway enters it. His statement before the Railway Committee of the House of Commons was that the cost of his railway into that country would be much greater and his operating expenses larger than the Kettle River Valley Railway; and that in consequence the latter road could make a much cheaper rate on freight, than the charge he wishes to establish on the Canadian Pacific. This can have only one meaning, namely, that without competition those who are endeavoring to develop this low grade ore, which requires above all things the cheapening of supplies and transportation, are to reduce their profits by such a sum as the C.P.R. thinks will satisfy them for carrying the freight. In view of the fact that the people of British Columbia have already made most liberal concessions to the C.P.R. in the hope that they will give railway transportation to the district, it seems rather hard to tell them now that they must pay, in addition, a freight charge upon all the production of their mines, exceeding the rate which can be established upon railway lines, the promoters of which, are simply asking the privilege of entering the country, and competing for the business there.

We fail to see upon what principle, either in reason or justice, the position taken by the opponents of the Kettle River Valley Railway can be maintained.

MINING NOTES.

Nova Scotia.

The Withrow mine at South Uniacke has been making an excellent show, its average for the last six months being about 125 oz. per month from about 150 tons of rock per month.

The Goldenville group of mines are coming to the front again. The Bluenose Co. returned over 400 ounces of gold from 1,130 tons of rock during the last two months.

We are pleased to notice that the Modstock mine has been yielding good returns lately, the returns for the last two months being 244 oz. from 560 tons of rock crushed.

The western part of the province is producing much more gold than it has done for some time past. The returns from J. N. Owen's mine, the Cashon Hinds mine and the Southerland Mining Co. aggregate over 200 ounces, while the Brookfield mine, which has not yet given in returns, may be relied on to add not less than 300 ounces to that amount.

The Annual Report of the Department of Mines for the Province of Nova Scotia, covering the fiscal year ended 30th September last, has been issued, and while it shows no improvement over its predecessors in the character of its descriptive matter, a good deal of valuable information may be gathered respecting the progress of mining by a reference to its numerous statistical tables.

From 1862 to 30th September, '97, we find that 1,029,923 tons of rock have been milled, yielding 654,446 ozs. 8 dwt. 14 grs. gold, or an average of 12 dwt. 16 grs. per short ton during that period. During 1897 the returns for the fiscal year show a yield of 26,963 oz. 14 dwt. 2 grs., compared with 26,112 oz. 10 dwt. 22 grs. in 1896. The following general statement will prove of interest:—

District.	Mills.	Tons Crushed.	Average Yield of Gold per ton. Oz.	Dwts.	Gr.	Total Yield of Gold. Oz.	Dwts.	Gr.
Wine Harbor	1	611		10	9	318	3	2
Gold River	2	287	1	17	20	542	19	5
Fifteen Mile Stream	2	9,158		6	5	2,856	18	..
Stormont	4	28,700		..	13	6,209	18	10
Brookfield	1	8,076		5	7	3,366	10	..
Caribou & Moose River	4	9,324		5	23	2,781	13	19
Uniacke, South and Mt.	4	2,344		19	9	2,274	4	4
Cochran Hill, Goldenville and Crow's Nest (Sherbrooke)	6	12,659		6	13	4,181	18	19
Waverley	1	806		13	7	461	8	..
Cow Bay	1	717		15	15	560	19	19
Tangier	1	372		16	2	299	14	.
Central Rawdon	1	963		4	3	199	12	..
Killag	1	112	3	10	8	393	19	..
Montague	3	956	1	..	6	1,177	1	7
Oldham	1	308		18	17	282	5	6
Leipsigate	2	167		7	8	82	7	..
Unproclaimed & others	....	929		13	15	625	18	2
Total	37	76,559				26,595	6	21

NOTE.—Additional returns bring the total amount of gold produced during the year to 26,963 oz. 14 dwt. 2 gr.

The following has been the production by districts from 1862 to 1896:—

District.	Tons Crushed	Total Yield. Oz.	Dwts.	Gr.	Value @ $19 per Oz.	Average yield per ton. Oz.	Dwts.	Gr.
*Caribou & Moose River	96,848	38,024	18	20	$722,473 89	0	7	20
Montague	21,696	37,894	1	19	719,987 70	1	14	22
Oldham	45,100	48,990	10	18	930,820 22	1	1	17
Renfrew	48,142	33,869	8	2	643,518 68	0	14	1
Sherbrooke	173,130	123,323	18	8	2,343,154 42	0	14	6
Stormont	80,316	42,313	19	13	803,965 57	0	10	13
Tangier	42,720	20,192	17	10	383,664 55	0	9	11
Uniacke	50,656	35,683	12	8	677,988 72	0	14	2
Waverley	121,540	60,847	1	2	1,156,094 03	0	10	0
‡Salmon River	95,601	39,373	7	18	748,094 37	0	8	5
‡Brookfield	14,360	11,534	5	4	219,150 91	0	16	1
‡Whiteburn	6,343	9,535	15	18	181,179 97	1	10	1
Lake Catcha	20,734	22,757	1	20	432,384 74	1	1	23
‖Rawdon, East Central	12,158	9,592	7	4	182,254 81	0	15	8
Wine Harbor	42,711	29,140	8	7	553,667 88	0	13	5
**Fifteen Mile Stream	27,738	15,346	3	5	291,577 05	0	11	1
Malaga, from '89 to '93	18,567	15,180	5	8	288,425 07	0	16	8
Unproclaimed & other Districts	62,522	44,722	10	3	$49,727 62	0	14	7
Total to 30th Sept., 1896	980,882	638,322	12	19	$12,128,130 20	0	13	0

*From 1862. †From 1866 ‡From 1883. §From 1887. ‖From 1882. ¶ From 1887. **From 1883

Marked progress has also been made in the coal trade of the Province, the output having increased from 2,235,472 tons in 1896 to 2,320,916 tons in 1897. The output and sales by collieries is concisely placed in the following statement:—

Colliery.	Output.	Sales. Round.	Slack.	Total Sales.
Joggins	73,357	59,488	13,049	72,537
Jubilee	40	40	.....	40
Scotia	1,280	799	255	1,054
Springhill	318,296	159,733	105,856	265,589
Acadia	213,050	119,689	60,193	179,882
Intercolonial	173,818	105,361	54,991	160,352
Dominion Coal	1,252,484	917,625	169,120	1,086,745
Sydney	267,626	192,310	37,539	229,849
North Sydney	4,809	4,079	980	5,059
Broad Cove	799	402	.....	402
Mabou	289	289	.....	289
New Campbellton	15,068	11,623	.....	11,623
	2,320,916	1,571,438	441,983	2,013,421

The other industries show: Iron ore, 44,146 tons; manganese, 100 tons; coke made, 45,000 tons; gypsum, 125,000 tons; grindstones, 32,400 tons; limestones, 25,000 tons.

Considerable excitement prevails throughout Nova Scotia over the latest find of gold at Whycocomagh in Cape Breton. Some thousands of areas have been taken up. The first discovery was made in the early part of last summer, and a tunnel has been driven across the strata for a distance of 130 feet. The property has been bonded to Upper Canada capitalists, who sent an expert down to examine the property. This expert took samples throughout the whole length of the tunnel; in all 12 samples were taken away, two of which gave only traces of gold, while the remainder gave from $20 to $144 per ton. Of course it is too early to say anything about this deposit one way or the other as yet. The indications from these assays point to its being a very valuable find, but we are inclined to think that more tests will have to be made before it can be definitely proved. It is rumored that a Montreal mining engineer is coming down to make an examination of the property, and every one will await the result of his report with considerable interest.

The returns from the Richardson mine were 243 oz. 15 dwts. of gold for the month of February.

The following returns from the Oldham Gold Co.'s mill, which has been doing custom work lately, are both interesting and instructive, inasmuch as they show how profitable mining on even a very small scale is in Nova Scotia:—

Month Crushed.	Owner.	Weight. Tons.	Cwt.	Gold. Oz.	Dwt.	Grs.
February	J. Cantfell	3	..	40	..	..
March	Sandy Cove	18	..	4	9	..
"	A. Wright	28	..	60	..	..
"	A. Horne	10	..	35	..	..
"	E. Vandergrift	5	..	1	2	12
"	F. Horne	7	..	10	12	12
"	R. McNeil	5	..	2	2	12
"	A. R. Horne	1	10	4	1	..
"	R. McNeil	10	..	3	17	..
"	Jubilee Co	2	..	61	..	..
"	J. Cantfell	5	..	40	..	..
"	H. W. Reeves & Co.	10	..	13	..	..
	Total	104	10	275	4	12

Or an average of 2 oz. 4 dwt. 22 grs. per ton of 2,000 tons.

The sworn returns of the mines taken from the Mines Office just before going to press show the industry to be in a very healthy condition:

Month.	Owner or Agent.	Ore Crushed. Tons.	Cwt.	Gold. Oz.	Dwt.
Dec. and Jan.	T. N. Baker	7	16	57	15
"	Dr. Cogswell	32	0	33	5
Jan.	Touquoy Mining Co.	109	0	47	16-5
"	G. Herschfield	273	..	67	5
Feb.	"	417	..	128	2
Jan.	Blue Nose Co.	625	..	190	..
Feb.	"	508	..	210	..
Jan.	J. N. Owen	144	..	127	10
"	Cashon Hines	245	..	125	..
Dec.	Elk Mg. Co.	110	..	45	10
"	Edward Walton	120	..	56	3
Jan.	J. Withrow	176	..	290	..
"	Modstock Mg. Co.	275	..	168	2
Feb.	"	285	..	176	12
"	Napier Co.	216	..	32	..
Jan.	Hopewell Co.	440	..	52	..
"	New Egerton Mg. Co.	260	..	73	12
Feb.	J. Murphy, Tangier	50	..	62	12

We were recently shown some very beautiful specimens of gold quartz by Mr. Sauve, from his property at Cow Bay, Halifax Co. The quartz carries a considerable quantity of galena and shows gold freely. A mill run of 4 tons gave 13 oz. 17 dwt. of gold, and we should imagine from the nature of the ore that a good deal was lost in the tailings.

The Whycocomagh boom has proved a perfect bonanza for the Mines Office, over 7,000 areas having been taken up. This wholesale system of blanketing new finds is causing a good deal of dissatisfaction among prospectors who make discoveries in almost untrodden ground, only to come to Halifax to find the whole district covered for miles.

The Local Government attached so much importance to the new gold finds at Whycocomagh that they sent Dr. Gilpin down to make a report on the property. We append the doctor's report as published in the local papers Dr. Gilpin says:

"The gold property to which my attention was directed lies about one and a half miles east of the village. There is a tunnel here driven 120 feet across the measures which dip eastwardly They comprise limestone, quartzite, slate, felsite, etc., all more or less mineralized, shattered and stained with rust. Samples were taken as follows:

No. 1, face of tunnel.
" 2, 30 feet from face of tunnel.
" 3, 60 " "
" 4, 90 " "
" 6, 105 " "
" 5, mouth of tunnel.

Sample 6 taken last—here placed in order of position.
These yielded an assay as follows:

No. 1, trace of gold.
" 2, " "
" 3, " "
" 4, " "
" 5, " "
" 6, " "
" 5, 3 oz., 7 dwt.

Samples of the bottom of the Indian river at its mouth yielded very good sights of gold. I was unable at this season of the year to get other samples of gravel, but consider it probable that it would show throughout the alluvium.

Owing to the depth of the snow I could form no idea of the extension of the belt of strata the tunnel is in, as the ground is covered deeply with snow. I should judge, however, that it would extend for at least over one mile.

The result of the assay shows that there is in the belt a bed at least eight feet wide, yielding such returns as warrant the expectation that the deposit will prove very valuable."

The present Government are certainly making a move in the right direction, and we congratulate the Hon. G. H. Murray on his decision to issue a report on Nova Scotia's resources, which will be principally devoted to the mining industry. If the making of this report is placed in proper hands it should be the cause of attracting capital into one of the most reliable gold fields in the Dominion.

(From another Correspondent.)

The total quantity of gold won in Nova Scotia for the calendar year is estimated to exceed 28,000 oz., the largest in the history of the Province.

The New Egerton Gold Mining Co., at Fifteen Mile Stream, owing to the increasing width of their large working belt as depth is attained, and the difficulty thereby of supporting the ribs of unproductive rock, have determined to erect a large cable hoist and work the mine by a system of open quarry work. The working belt is over 150 feet wide.

The District of Oldham is again beginning, after a year or two of quietude, to make returns that look something like former days. We notice one return 28 tons 58 ozs. One of 5 tons 38 ozs., and yet another of 3 tons 37 ozs. Those returns are all from old mines which had been closed down for years.

The re-opening of the once famous Dufferin has commenced in earnest, large contracts for machinery, lumber and timber have been let, and it is said there are a hundred men already at work on the premises. We notice, with no regrets, an exodus, from several other districts, of the parasitical element that have helped to swamp more than one good mine in this Province. We would strongly advise the management of the Dufferin to fraternise a little with some of Nova Scotia's successful managers before condemning and deprecating too strongly the mine labour of the Province.

J. B. Neily & Co., have succeeded in getting in on the snow, a large lot of machinery, which they will erect immediately on their mine at Gold Lake, Halifax Co. The mine was fully proved last fall, with a small mill, to be of great value.

The interest of the Whycocomgh discoveries is not abating, over 4,000 areas have already been secured. The owners of the original areas where the discoveries were made, immediately after getting their tests made secured large adjoining blocks.

Already many strangers have came into the Province to enquire into the possibilities of gold mining, the majority of whom are delighted and surprised at what they have seen and learned. Already there is an unusual effort by middlemen, those who live by their wits, to bond up all available mines. I would strongly advise those who have mines to sell not to tie them up to men of the above stamp and thus be the means of helping to keep capital out of the country.

British Columbia.

NELSON DISTRICT.

But little of consequence has transpired in mining circles during the past month, our long Kootenay winter rendering any fresh prospecting quite impossible. There are, however, certain unmistakable signs that the back of the winter is broken once more and that the prospectors' season will not be much longer delayed—indeed a few venturesome spirits are already starting out on snowshoes for their claims, so as to have all in readiness for the intending investor when he comes to inspect the property.

It is unfortunate in this locality that spring is not ushered in with the "lark soaring into the blue empyrean," nor does the earth suddenly become covered with gorgeous wild-flowers; instead thereof the ground is all deep, soft and liquid mud, while the only larks are not of the feathered variety; but all the same the signs are very acceptable and tend to increase that hopeful feeling for the next season which is perennial in the breasts of all good British Columbians.

The Fern mine is still well in front and showing good returns, the manager reporting the last shipment to have yielded over 7 oz. of gold per ton, which must be regarded as highly satisfactory. The cyanide plant which has been decided upon will very shortly be in operation, the management having apparently been wisely cautious in selecting the particular system best suited to their ore, instead of putting down the one that may be "cracked up" more, but actualty not so well suited to the prevailing conditions.

In the same neighborhood—on Toad Mountain that is to say—the Goldendale seems to be improving very much; it is claimed that the ledge is some 40 feet wide, with a pay streak of about 2 feet, consisting of quartz highly mineralized with copper and galena and showing occasional specimens of silver glance, all assaying well and giving great satisfaction to the owners.

Another small location—the J. R. C.—adjoining the celebrated Dandy mine, is reported to be improving daily as work is done on it, but it is too early yet to say what it may prove to be worth.

The Delight group is being steadily worked, and has been so all the winter, So far, however, no shipments have been made, but the ore is retained until the advent of such weather as shall enable the material to be handled economically—the claim being situated rather inconveniently for cheap delivery to the smelter

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As regards the Athabasca, that well managed property is still sending ore down regularly to the Hall Mines furnace, and making very profitable returns; this property certainly has fulfilled the hopes of its owners and will undoubtedly prove a bonanza for the shareholders; although of course considerably more money must be expended, yet the constant income from the sale of the ore will help to mitigate that inconvenience.

At Ainsworth it is reported that the Twin mine is about to be worked on a much larger scale than hitherto. It appears some considerable English capital has been secured, and the property will be thoroughly opened up.

What, however, may affect Ainsworth temporarily to her disadvantage is the very prevalent rumor that the Omaha and Grant Co. have decided to withdraw from active operation in West Kootenay, as, if that report be true, some two or three mines may have to suspend operations for the present—always an unsatisfactory proceeding in any camp, though unfortunately not very uncommon.

In the Ymir district, from which great things may be expected this year, one of the best known mines—the Jubilee—has been bonded, it is said, for $60,000, and as the property seems rather a valuable one with a good deal of work done on it, the price does not seem so outrageous as usual.

I had the doubtful pleasure recently of inspecting a claim for which that sum was asked, upon which less than $750 worth of work had been done, and which assayed about $10 per ton at the best. It is such absurd work as this that simply sickens the intending investor and drives him out of the country. The Duncan mines, in the Ymir district, are showing up well according to all accounts, and the management intends to greatly increase the force of men at work there as soon as the snow gets off the place sufficiently. The ledge is said to be 10 or 12 feet wide at the face of the 300-foot tunnel, which certainly sounds very good.

On the Tamarac—same district—the owners report a ledge 2 to 3 feet wide assaying as high as $100 per ton. One cannot always take all these glowing reports as being absolutely true, but there is no doubt whatever that the camp as a whole is a remarkably good one, and well worth the attention that is being given to it.

The Hall Mines Co.'s Silver King and their smelter have both been working to their full capacity, the new large blast furnace having smelted actually some 270 tons of ore daily, besides fuel and flux, for many days in succession. The matte produced is now all worked up into metallic copper at the smelter, and is being shipped east in that condition.

It is a matter of sincere congratulation that Mr. R. G. McConnell, of the Dominion Survey, has been appointed successor to Mr. Carlyle as mineralogist. No one who knew Mr. Carlyle could help regretting that he decided to leave the position he filled so ably and with such unvarying kindness and courtesy to accept another one, although it was much to his personal benefit to do so; but, as it had to be, no better successor can be found than Mr. McConnell. Many names were handed about as being likely aspirants for the honor, but none have anything approaching Mr. McConnell's experience and ability, and hence we may think ourselves fortunate that the choice has fallen on him.

Speaking of mineralogy, some of your readers may be interested to know that tungsten exists here. Last summer an old friend of mine brought me some very heavy yellow rock, which he requested me to assay for lead, silver and gold. Being very much occupied at that time, finding there was no value in the ore, I put it on one side for further investigation, as I did not at once recognize it, and it proves to be scheelite. A rough analysis gives Lime 13.75 per cent., tungstic oxide 74.30 per cent., with a good deal of silica—in fact the mineral was in contact with solid quartz. Sp. gr. is 5.1 and hardness about 4 to 5, varying a good deal in different parts. Will any

of your readers who know about these matters kindly say whether any market exists for that mineral, and if so, where? Any information will very greatly oblige.

There has been lately a great deal of talk about some heathen country called Klondyke, which is reported to be very rich in gold and probably other valuable metals. All such statements may be correct, but in the meantime it is as well not to forget that the actual value of the exports from West Kootenay during January and February, 1898, amounted to no less than $2,069,710. March is not included.

Some enterprising individual had better try and cultivate laurel trees in Klondyke—the locality may need them badly before long!

A. H. H.

Nelson, B.C., March 15, '98.

NEW DENVER.

The season of snow-slides is upon us and as a consequence many of the mines find it expedient to curtail operations to some extent in lieu of closing altogether. Although taken as a whole the demand for properties is weak compared with that of last year, owing chiefly it is supposed to the force of counter attractions, there are occasional bright stars in the firmament which more than atone for the apparent neglect which is manifest on the part of capitalists. Not the least of these is observable in the recent sale of the Whitewater to a representative London syndicate. Backed by such brilliant achievements in the past there can be little doubt of the benefits which will accrue to the company having the good fortune to acquire it. Strange to say, although little has actually been done in the matter, rumours are flying high with regard to the impending sale of quite a number of the really good Slocan properties. Klondyke or no, a strong undercurrent of interest is bound to assert itself here before the summer is over, with results beneficial alike to the prospector and investor. Another competitor appears to have entered the field among the active producers in the race for supremacy, so long and worthily sustained by the Payne mine. Great things are spoken of the Last Chance, and although in the matter of output it is at present considerably in the rear of the leaders, it is pretty broadly hinted that this state of affairs will not long continue. Work at the Noble Five has not as yet been resumed, reports to the contrary notwithstanding. It will be a thousand pities if the excellent tramway and concentrator at this mine are allowed to become useless for want of operation. It is high time something was done by those in authority to clear away the present uncertainty.

The Slocan mineral belt is continually widening until it seems to have absolutely no limit, or more correctly speaking no definite geological line of demarcation. Ore characters may change and do in different localities, but they all appear to merge imperceptibly and penetrate as it were the one into the other, sometimes without even the formality of a barren or neutral zone in between.

After a somewhat hasty survey three years ago, it became generally recognized that the rocks composing the western shore of Slocan Lake were not of the mineral bearing variety and consequently were best left severely alone. Gradually, however, this fallacy, for such it appears to be, is being exploded by the praiseworthy and persistent efforts of those most interested in the matter. A number of unimportant finds have been recorded in the past, but now ore has been discovered up Trout Creek as the result of systematic search on the part of two prospectors which comes as a surprise to the erstwhile sceptics. It is not high grade and is of a somewhat complex character consisting of iron and copper pyrites intermixed with galena and zinc-blende, but being in considerable quantity, is likely to be heard from directly in the near future.

Speaking of strange ores, a recent analysis of a sample from the L. H situated on the Eight Mile showed 80 per cent. arsenic and 4 per cent. silver, the balance being composed of silica with a trace of iron. As would be expected of such ore it is found exclusively in pockets along one wall of the vein and probably furnishes the only illustration in the Slocan of the result ot sublimation underground. Interesting and valuable discoveries in this connection are quite within the bounds of possibility.

The Mollie Hughes group opposite New Denver has been taken over by a local company with the avowed object of prosecuting development to the best advantage. These claims were located as early as 1892 before even the K. & S. Railway was constructed, and have passed through a number of vicissitudes. An eight ton shipment some time since averaged over two hundred ounces in silver and thirteen dollars gold to the ton.

Four Mile properties are progressing steadily; little is now heard of the Galena Farm, and the Wakefield and Fisher Maiden have not as yet been reopened, but the Comstock (late Thompson Group) and Vancouver continue to ship. The stock in the former of these, owned by a Glasgow Syndicate, is said to have exhibited an upward tendency of late owing to the promising condition of the mine.

Tenders are out for erecting the long promised sampling works at Rosebery, but the public has almost lost confidence in the venture through the tardy manner in which the preliminary operations have been carried on. It is openly asserted that a townsite boom is at the bottom of the whole matter. This would be doubly regrettable because it is really an excellent location for an establishment of this kind and could be amply supported.

Great interest is professedly evinced by the miners in the so-called transmutation process of Dr. Emmons, but it appears to carry little weight so far as lessening the absurd rush of men of every description to the Klondyke is concerned. How any man in his senses can relinquish steady and profitable employment in a rich mining country like this to go seeking imaginary wealth in a cold inhospitable climate, passes the comprehension of ordinary mortals.

Changes in the Act relating to the location of and recording of mineral claims by prospectors appear to be imminent and not before they are needed. Whatever is done in the matter by the Government will doubtless result from the exercise of care and caution, such as we are unaccustomed to in legislative affairs in this Province. A thorough revision of the Act will commend itself at once to all thoughtful persons acquainted with the deceit and fraud which is daily practised in western mining camps.

HOWARD WEST.

March 16th, 1898.

BOUNDARY CREEK DISTRICT.

Railway matters are attracting a very considerable amount of attention to this district just at present. As regards the mining outlook, it has never been better. Nearly every working property in the district is looking well. The cross cuts and drifts at the bottom of the 100 feet winze on the "Mother Lode" have opened up much better ore than has ever before been taken out. Mr. Fredrick Keffer, the engineer in charge, has gone east to New York.

The old Ironsides has been cross cutting in ore for some time and is now in ore for over 50 feet. The ore has undergone a remarkable change. On the surface it was magnetite carrying copper pyrites. At a lower depth it was very calcitic with some quartz, specularite, magnetite, and copper pyrites, while at the present level it is almost wholly quartz and copper pyrites with greatly improved gold values. Work in the same camp is proceeding very satisfactorily on the Snowshoe. The shaft is now down 91 feet. The ore on this claim is more silicious at the bottom of the shaft than on the surface.

The "Brooklyn" in the same camp is now being worked. It has been bonded by McKenzie & Mann. This property has a 40 foot vein.

Since the setting up of the machinery on the Golden Crown work has been resumed on the shaft.

Work has been started on the Republic Group, which is under bond to G. D. Mackay for the Anglo Columbian Syndicate. This group consists of the Repubic, Last Chance, Hidden Treasure and Nonsuch claims. The Nonsuch is the first location in the district.

The shaft on the C. O. D. Long Lake Camp is down 55 feet, and is looking well. Work has been resumed on the Enterprise which has been recently bonded to Mackenzie & Mann. Some exceedingly rich telluride ores have recently been taken out.

Proceedings of the Eighth Annual Meeting.

The eighth annual meeting of the members of the General Mining Association of the Province of Quebec was held in the Club Room, Windsor Hotel, Montreal, on Tuesday evening, 1st March, the President, Mr. Geo. E. Drummond, in the chair. There was a good attendance, including Dr. Porter and party of mining students trom McGill, and Dr. Goodwin and party of mining students from the Kingston School of Mining.

Mr. B. T. A. BELL, Secretary, read the minutes of previous meetings and presented a report of the work done by the Association during the year.

The minutes and report were on motion adopted.

Mr. A. W. STEVENSON, C.A., Treasurer, presented his financial statement for the year, showing receipts $1,118.40 and disbursements $1,029.18. In addition to the balance on hand of $89.22, there was owing the Association by the Quebec Government $316.53.

The report was on motion adopted.

On motion of Mr. H. W. DeCourtenay, the sum of two hundred dollars was voted to the Secretary for his services during the year.

QUEBEC MINERAL OUTPUT, 1897.

The Secretaay submitted the following approximate estimate of the value of the mineral production of the Province during the year 1897:—

Mineral.	Employees.	Output.	Approximate Value.
Asbestos and asbestic	750		$650,000
Mica	90		125,000
Copper pyrites	270	36,815 tons	131,730
Copper	10	20 "	2,000
Chromite	80	2,340 "	32,770
*Gold	35		1,000
Graphite			2,000
Felspar			5,000
*Silver and lead	25	430 tons	5,300
Ochre	50	1,240 "	12,400
*Phosphate		424 to Canada	
"		84 " United States	
"		506 " Great Britain	
		1,014 tons	6,084
Charcoal pig iron		Radnor Forges only	231,400
Iron ore	680	19,766 tons	41,220
Slate	90		50,000
Flagstone	10		7,000
Lime	250		140,000
Bricks	1,200		600,000
Cement	40		22,000
		Total estimated value.	$2,064,904

By-product of mica

Dr. J. B. PORTER, in name of McGill University, and speaking as the head of the Department of Mining, extended a cordial invitation to the members of the Association to visit the new mining and metallurgical laboratories erected and equipped by the munificence of Mr. W. C. McDonald.

The President thanked Dr. Porter on behalf of the Association, and said that he had no doubt many of the visiting members would avail themselves of the invitation to visit the laboratory.

STUDENTS' COMPETITION.

The Secretary reported that the Council had awarded the Students' prizes for papers contributed to the proceedings of the Association as follows:

1st. Mr. J. Walter Wells, School of Mining, Kingston. Subject: "The Mispickel Ores of Deloro, Ont."

2nd and 3rd (equally) Mr W. M. Ogilvie and Mr. H. Nellis Thompson, McGill College. Subjects: "Gold Mining in the Yukon," and Asbestos Mining and Dressing at Thetford, Que."

Mr. T. A. McLean (McGill) presented a capital paper on "Coal Cutting and Transportation, with special reference to Cape Breton mines."

The meeting then adjourned until close of the sessions of the Federated Institute.

The members re-assembled on Saturday morning, the President in the chair.

THE LATE HON. GEORGE IRVINE, Q.C.

The Secretary referred in feeling terms to the loss sustained during the past year by the death of the first President, the Hon. George Irvine, Q.C., of Quebec, and moved a resolution of sympathy with the family of the deceased gentleman.

The motion was adopted.

ELECTION OF OFFICERS

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

Past Presidents.

Mr. JOHN BLUE, C. & M.E., Eustis, Que.
Capt. ROBERT C. ADAMS, Montreal.

President.

Mr. GEORGE E. DRUMMOND (Canada Iron Furnace Co.), Montreal.

Vice-Presidents.

Mr. JAMES KING (King Bros.), Quebec.
Mr. H. A. BUDDEN (Intercolonial Coal Co.), Montreal.
Mr. W. A. ALLAN, Ottawa.
Mr. JOHN E. HARDMAN, S.B., Montreal.

Treasurer.

Mr. A. W. STEVENSON, C.E., Montreal.

Secretary.

Mr. B. T. A. BELL, Editor *Canadian Mining Review*, Ottawa.

Council.

Mr. GEO. R. SMITH, M.L.A. (Bell's Asbestos Co.), Thetford Mines, Que.
Mr. JOHN J. PENHALE (United Asbestos Co.), Black Lake, Que.
Mr. R. T. HOPPER (Anglo-Canadian Asbestos Co.), Montreal.
Mr. MILTON L. HERSEY, B.A. Sc., Montreal.
Mr. W. T. BONNER, Montreal.
Mr. C. H. CARRIER, Levis, Que.
Mr. THOS. J. DRUMMOND, Montreal
Mr. H. W. DE COURTENAY, Montreal.
Mr. J. STEVENSON-BROWN, Montreal.

NEW MEMBERS.

The following new members were elected:

P. P. Hall, Quebec.
Alex. B. Allan, Glasgow.

On motion the whole of the membership of the Association were transferred to the membership of the Canadian Mining Institute on the terms of subscription provided for members of provincial mining organizations.

This being all the business the meeting adjourned.

SECOND INTER-PROVINCIAL CONFERENCE OF MINING ENGINEERS & MINE MANAGERS.

Important Resolutions Adopted—Opposed to Export Duty—Many Valuable Papers Read.

The second Inter-Provincial Conference of Canadian Mining Engineers, Mine-Managers and Mining men was held in the Windsor Hotel, Montreal, on 2nd, 3rd and 4th March. There was a large attendance among others present were noticed:—

Mr. John Blue, C. & M.E., Eustis Mining Co., Capellton, Que.
Mr. Charles Fergie, M.E., Intercolonial Coal Co., Westville, N.S.
Mr. Wm. Braden, M.E., Pilot Bay Smelting Works, Pilot Bay, B.C.
Mr Frank C. Loring, M.E., Josie Gold Mining Co., Rossland, B.C.
Mr. C. J. Christie, M.E., Dawson, N.W.T.
Mr. A. E. Hogue, M.E., Edmonton, N.W.T.
Mr. Wm. Blakemore, M.E., Crow's Nest Coal Co., Coal Creek, B.C.
Mr. John E. Hardman, S.B., M. E., Montreal, Que.
Mr. W. Hamilton Merritt., A.R.S.M., Toronto, Ont.
Mr. F. T. Snyder, Ottawa Gold Milling & Mining Co., Keewatin, Ont.
Dr. J. B. Porter, Professor of Mining, McGill University, Montreal, Que.
Mr. J. Obalski, M.E., Inspector of Mines, Quebec, Que.
Dr. George M. Dawson, C.M.G., Director of Geological Survey of Canada, Ottawa.
Mr. E. D. Ingall, A.R.S.M., Geological Survey, Ottawa.
Mr. F. Cirkel, M.E., Ottawa.
Mr. W. J. Gage, M.E., New York.
Mr. Spencer Miller, C.E., New York.
Mr. John J. Drummond, M.E., Canada Iron Furnace Co., Radnor Forges, Que.
Mr. Geo. E. Drummond, Canada Iron Furnace Co., Montreal, Que.
Mr. George R. Smith, M.L.A., Bell's Asbestos Co., Thetford Mines, Que.
Mr. G. E. Francklyn, General Mining Association, Ltd., Halifax, N.S.
Mr. Harvey Graham, Nova Scotia Steel Co., New Glasgow, N.S.
Mr. J. T. Burchell, Cape Breton Colliery, New Campbellton, C.B.
Mr. Clarence Dimock, Wentworth Gypsum Co., Windsor, N.S.
Mr. C. Kirchoff, Editor, *Iron Age*, New York.
Mr. John Birkinbine, M.E., Philadelphia, Pa.
Mr. H. A. Budden, Intercolonial Coal Co., Montreal.
Dr. W. L. Goodwin, Director, School of Mining, Kingston, Ont.
Mr. W. J. Nelson, Intercolonial Coal Co., Montreal.
Mr. Alfred Willson, Commissioner Canada Company, Toronto.
Mr. Archibald Blue, Director of Mines, Toronto.
Mr. W. R. Lindsay, East Kootenay, B.C.
Mr. C. H. Hamilton, M.E., Winnipeg, Man.
Dr. James Reed, Harvey Hill Copper Mine, Reedsdale, Que.
Mr. John J. Penhale, United Asbestos Co., Black Lake, Que.
Prof. W. G. Millar, School of Mining, Kingston, Ont.
Mr. R. T. Hopper, Anglo-Canadian Asbestos Co., Montreal.
Mr. Lionel H. Shirley, C. & M.E., Montreal, Que.
Mr. T. A. Knowlton, Foster, Que.
Mr. A. Macdonald, St. Johns, Que.
Mr. Hugh D. McKenzie, Intercolonial Coal Co., Halifax, N.S.
Mr. M. H. Wylde, Secretary Mining Society of Nova Scotia, Halifax.
Mr. E. Stairs, Halifax, N.S.
Mr. James F. Lewis, Rand Drill Co., Chicago, Ill.
Mr. Fred Brainerd, New York.
Mr. Dwight Brainerd, Hamilton Powder Co., Montreal, Que.
Mr. Daniel Smith, Ontario Powder Works, Kingston, Ont.
Mr. W. E. Paton, Sherbrooke, Que.
Mr. Jas. S. Mitchell, Sherbrooke, Que.
Mr. H. D. Lawrence, Beaver Asbestos Co., Sherbrooke, Que.
Mr. B. F. Peacock, Abbott Rolling Mill, Montreal, Que.
Mr. D. A. Brown, Bell's Asbestos Co., Boston, Mass.
Mr. H. A. Bell, Bell's Asbestos Co., London, Eng.
Mr. John Patterson, Hamilton, Ont.
Mr. A. W. Dingman, Toronto, Ont.
Alderman Davis, Hamilton, Ont.
Mr. Charles Archibald, Halifax, N.S.

Mr. R. W. Brock, Geological Survey, Ottawa.
Dr. Robert Bell, Assistant Director Geological Survey of Canada, Ottawa.
Mr. R. W Leonard, C.E., Ottawa, Ont.
Mr. J. F. Higginson, Buckingham, Que.
Mr. J. T. McCall, Montreal.
Mr. H. W. DeCourtenay, Montreal.
Mr. W. F. Cockshutt, Brantford, Ont.
Mr. Frank B. Baird, Buffalo, N.Y.
Mr. C. E. Morgan, Toronto.
Mr. T. J. Drummond, Montreal
Mr. J. Stevenson Brown, Montreal.
Mr. Robert Meredith, Montreal.
Dr. Frank D. Adams, McGill University, Montreal.
Mr. A. W. Stevenson, C.A., Montreal.
Mr. W. T. Bonner, Babcock & Wilcox Co., Montreal.
Mr. J. M. Jenckes, Jenckes Machine Shop, Sherbrooke, Que.
Mr. E. W. Gilman, Canadian Rand Drill Co., Montreal.
Mr. S. J. Simpson, James Cooper Mfg. Co. Montreal.
Mr. C. D. Hansen, M.E., Rat Portage, Ont.
Mr. E. A. Sjostedt, M.E , Montreal.
Mr. Milton L. Hersey, M E., Montreal.
Mr. Roy Sweny, Toronto.
Mr. C. H. Wilkinson, British Yukon M. Trading and Transportation Co., Ottawa.
Major Robert G. Leckie, M.E., Truro, N.S.
Mr. J. F. Piggott, Spokane, Wash.
Mr. D. W. Robb, C.E., Robb Engineering Co., Amherst, N.S.
Mr. George F. McNaughton, New Egerton Mining Co., Fifteen Mile Stream, N.S.
F. J. Appleby, Assoc. M Inst., C.E., Montreal.
Hugh C. Baker, Blackburn Mine, Templeton, Que.
Capt. R. C. Adams, Adams (B.C.) Mining Co., Montreal.
B. T. A. Bell, Editor CANADIAN MINING REVIEW, Ottawa.
Also a large party of mining students from McGill and the School of Mining, Kingston.

The President Mr. George E. Drummond, took the Chair at eleven o'clock.

THE SECRETARY read the minutes of the previous meetings which were confirmed; he then presented a detailed audited financial statement of the affairs of the Institute, showing: Receipts, $1,011.96; and Disbursements, $1,068.11; Assets, $144.55; Liabilities, $404.50. He briefly reviewed the work of the Institute during the year, dwelling particularly on the work accomplished on behalf of the mining industry in opposing the Bill of the Canadian Society of Civil Engineers in the Legislatures of Nova Scotia and Quebec, and also with regard to the Tariff respecting mining machinery.

MR. HAMILTON MERRITT thought every mining engineer in Canada would endorse the action of the Institute in blocking such an arbitrary measure as that of the Canadian Society of Civil Engineers. He thought the thanks of the Institute were especially due to their Secretary for his energetic action in the matter, and to the splendid co-operation of the members of the Mining Society of Nova Scotia. He would therefore move: That the Federated Canadian Mining Institue approve of the action of the Council in exerting their influence to oppose the effort of the Canadian Society of Civil Engineers to compel mining engineers to become members of their Society before being able to practice in Canada.

MR. HARDMAN having seconded the motion to was put to the meeting and carried unanimously.

THE SECRETARY said he believed the time had come when the present federation should cease and a consolidated organization of the mining men of all the Provinces of the Dominion take its place. A committee had been ointed by the Council of the Institute to prepare a report on the subject and had issued a circular asking for the views of the leading mining men. The responses had been most satisfactory, and it was likely steps would be taken to organize such a body at the close of the sessions.

MR. HARDMAN having presented the report of the Special Committee said:—"I would like to propose a resolution in this connection. I may say that the funds we have received for our Federated Institute have proved inadequate for the purpose for which they were intended. We have gone behind during the past year. The utility of some of the printed papers has been very much lessened from the fact that we did not have funds enough to reproduce, on a proper scale, many of the working drawings furnished in connection with their papers. Another matter to be considered was whether any new organization should be based on the broad lines of the American Institute of Mining Engineers, or whether its membership should be confined simply to engineers and other professions co-related with mining.

THE SECRETARY believed that Canada as a mining country was too young yet for the establishment of an exclusive corporation, and he would favor a new organisation on the broadest lines possible. With respect to existing provincial organisations it was not intended to interfere with them in any way. Some of them only existed in name and would go out of existence with the organisation of the new Institute.

MR. DIMOCK: "I fully concur with Mr. Bell's idea—the membership should include all who are in any way interested in mining. I am very glad to hear Mr. Bell say that it was not intended to do away with the Provincial Associations. We in Nova Scotia, desire to maintain our Society, for many Nova Scotia mining can get into Halifax once a year to attend our meetings who could not get away to a meeting outside of their own Province.

MR. E. D. INGALL was heartily in favor of the organisation of a strong representative body of Canadian mining men.

THE CHAIRMAN: So far we have always worked harmoniously together. It is to be hoped that the members of provincial societies will feel that the new organization will in no way interfere with these interests.

THE SECRETARY: The question before the meeting is, whether we shall dissolve the present federation, and in order to bring the discussion to a focus, I would therefore move: That this meeting adopt the report of the Committee and Resolve that the Federation be dissolved at the close of the present sessions.

MR. MERRITT seconded the motion.

The Chairman put the motion which was carried unanimously.

THE SECRETARY moved: That Messrs. Hardman, Blakemore, Stevenson, Wylde, Fergie and Hamilton Merritt be a committee to consider the best means of winding up the affairs of the Federation.—Carried.

MR. HARDMAN suggested that the Committee report before the close of the sessions, and recommended that Mr. A. W. Stevenson, C.A., be appointed liquidator.

The Meeting then adjourned.

Opposed to Export Duties.

The members re-assembled at three o'clock, the President in the Chair:

MR. B. T. A. BELL: Perhaps I may be permitted to call the attention of the members of this Institute to the effort being made in certain quarters to have the Dominion Government impose an export duty on certain ores and minerals shipped from Canada into the United States. I need hardly say that any such policy at the present time would be a fatal mistake and would be disastrous in its consequences to many of our most important industries. However desirious we may be to have smelting and refining industries established in Canada, these can only be built up by favorable economic conditions. Experience has shown that for successful smelting much more is required than the neighborhood of a mine, and the concentration of smelting works at a few points where suitable fuel and fluxes, market connections and variety of ore supply can be obtained is proof that the lesson has been learned. An export duty would seriously cripple the operations of many of our silver-lead and auriferous pyrrhotite mines in British Columbia; it would certainly annihiliate our pyrites industry in Quebec and give to the New Caledonia mines the United States market for our Sudbury nickel ores and matte. I understand this movement is particularly directed against the nickel industry by certain promoters of a company which proposes, provided this export duty is placed on our nickel ores, to establish a nickel refinery and a nickel-steel works in Canada. It is claimed that Canada possesses the greatest nickaliferous pyrrhotite deposits in the world, and that nickel can be refined as cheaply in Canada as in the United States. Perhaps I may be permitted to quote some authorities in refutation on these points. Mr. Joseph Wharton, an authority on nickel refining, says in his excellent monograph on "Nickel and Cobalt," published by the United States Government in 1897:—"It is conceivable that the intimations of an export duty upon nickel ore and matte which from time to time appear in Canadian journals may some day be realized, and cause serious search to be made in this country for the deposits of nickel ore which doubtless exist and of which the now dormant Gap mine is an instance. Such an export duty would, no doubt, direct attention afresh to the great deposits of nickeliferous pyrrhotite in Norway and Sweden which have been for many years neglected. Barring such a contingency the Sudbury region seems destined to remain for a long time one of the two chief sources of nickel of the world, *the only rival* to meet it on equal terms being the Island of New Caledonia with its unlimited resources of nickel silicate, only a part of which are controlled by the French company "Le Nickel." Again on page 330 (Mineral Statistics U.S. 1896). "At present either one of the two great nickel regions of the world, namely, that near Sudbury in Canada, or that upon the island of New Caledonia, is capable of supplying all the nickel needed for the world's consumption; neither region is worked to half its capacity and neither need fear exhaustion even at an increased output for many years. It cannot be seriously maintained that these two rather small districts possess all the available nickel of the world and we may as reasonably expect some future discoveries of resources still better than these as to apprehend that these will be exhausted or prove inadequate for the world's needs." Even stronger than these is the statement of Mr. Robt. M. Thompson, President of the Orford Copper Company, who sends me the following wire.—"A Canadian export duty will close the United States market to the product of the Canadian mines unless the mines pay the duty by lowering their prices, because the New Caledonia mines can supply the world's demands and are willing to sell us all the ore we require as low and even lower than the prices we now pay the Canadian mines. This applies as well to so much of the European consumption as is supplied by our refinery from Canadian mattes, and these two items cover all the present Canadian products. Very few appreciate how small is the consumption or how great is the difficulty of refining nickel. We established our refinery at New York because we obtained there a reagent necessary for our process and which is a by-product of chemical manufactures not working in Canada. To ship this into Canada will make the cost prohibitory." The statements of these eminent authorities are worthy of consideration, clearly indicating as they do, the danger that threatens our nickel mining and smelting enterprises if the pernicious representations of a few company promoters should result in an export duty being placed on this mineral.

As a matter of fact the mining industries cannot yet bear the burden of creating prematurely by main force all the other industries which may become desirable hereafter. Additional duties laid upon it will only weaken it without producing the benefit intended; neither the copper mines nor the nickel mines can stand the imposition of an export duty. Let the mining industry have a fair chance to develop and strengthen itself; to gather a population of consumers around it; to give national birth to associated and auxiliary industries. Then the situation may be different. At present the proposal of an export duty is distinctly unwise because premature—to say nothing of all other reasons for opposing it. I beg, therefore, to submit the following motion:

Resolved,—That the sense of this representative meeting of the members of the Federated Canadian Mining Institute is opposed to an export duty being placed on any Canadian ore, matte or bullion, believing that such an impost would be prejudicial to the best interests of mineral development in the Dominion.

CAPTAIN ROBT. C. ADAMS, Midway, B.C.: I have very great pleasure in seconding the resolution.

ALDERMAN DAVIES, Toronto: I understand that the money spent in Canada in mining nickel and in smelting the matte is insignificent compared with the hundreds of thousands of dollars expended in refining our raw material in New Jersey. An export duty would mean that expenditure in Canada, giving labour to Canadians. We are becoming more and more independent of the United States, and the more industrial development we have in Canada the greater the population we will attract to the country. I think Mr. Bell's

proposition entirely in the wrong direction. We have the greatest country in the world, and what we want is more money. If an export duty was imposed English capital would be found to build nickel refineries in Canada.

MR. BELL: Alderman Davies' remarks are the merest frothy clap trap. The Canadian Copper Company has invested at Sudbury several millions of dollars in establishing mines and smelters, and a nickel industry that is distinctly creditable to the country. The erection of a refinery is entirely an economic question. If any one is prepared to refine nickel in Canada, the proper course would be to assist such an enterprise by a bonus similar to that already given by the Government to the manufacturers of pig iron and the smelters of silver lead.

MR. JOHN PATTERSON (Hamilton): I have been interested in the nickel question for some time, and I am a firm believer in the imposition of an export duty on Canadian nickel

MR BELL: You are interested in promoting an opposition company.

MR. A. W. DINGMAN (Toronto): I do not think the present time opportune to impose an export duty, and its imposition would certainly not bring about successful nickel refining in Canada. A great deal of misapprehension existed about the nickel industry. It was not the highly remunerative business many people imagined The Dominion Mineral Company which was a Canadian and English Company, had failed to make their Sudbury mines a success and were closed down to-day. The Vivians of Swansea, the great Welsh smelters and refiners, had also tried, unsuccessfully, to operate their Murray mine in the same district The Drury Nickel Company, a Chicago enterprise, which had worked the mineral at Sudbury had also gone into liquidation. As a matter of fact the Canadian Copper Company was the only enterprise to make a success out of the business. About a million and a half dollars had been invested in the enterprise, and from three to five hundred persons were employed at their Sudbury mines and smelters all the year round. In addition to this large expenditures on plant and wages, large sums were expended monthly in freights to Canadian railways and on machinery and supplies purchased in Canada. Surely it would not be wise to disturb such an important industry. He believed that an export duty at the present time would displace Canadian nickel in the American market in favor of the mines of New Caledonia. He would strongly urge upon the Government the desirability of appointing a Commissioner to enquire into all the facts before committing itself to any definite policy in the matter.

MR. HARDMAN suggested that Mr. Bell's resolution be brought up at another session as the programme for the afternoon was a long one.

MR. WM. BRADEN (Pilot Bay, B.C.): The placing of an export duty on ores would be a hardship upon the miners of British Columbia, as it would bar out the United States smelters from competition for these ores

MR. BELL having agreed to postpone further discussion until the Thursday morning session, the matter then dropped

(The Secretary introduced his resolution on Thursday morning, when it was adopted unanimously on a standing vote being called for by the Chairman.)

THE PRESIDENT'S ADDRESS.

THE PRESIDENT: Gentlemen,—It becomes my pleasant duty, as President of the Federated Canadian Mining Institute, to welcome you to-day to our Second Annual Meeting. To the distinguished representatives of the American Mining Institute, who honor us with their presence, I tender, on behalf of the members of this Institute, a most hearty and fraternal welcome. Never, I suppose, in the history of Canada, did a body of men interested in devising ways and means to aid in the development of their country, and especially the advance of the enterprise in which they hold common ground, meet at a time more opportune, more interesting, and more pregnant with great events, than do we of the Federated Mining Institute to-day. For years we have met together annually in our Provincial Associations to discuss the mineral resources of the Provinces and of the Dominion, to consider and overcome, when possible, difficulties natural, legislative, and technical, and perhaps above all to seek to awaken here in Canada and beyond her borders an interest in the magnificent mineral wealth of our country. We have had at times reason to be discouraged at the apparent slow growth of confidence on the part of the public, perhaps especially so in the case of the Canadian people, whom we felt never fully appreciated the great importance of developing the natural mining wealth of the country, and thereby strengthening and building up every other industry and interest in the community, but the year 1897 came in, and has proved a year that, nationally speaking, will pass into history, for Great Britain and her Colonies as a year of marked triumphs. The expression of kindred within the empire, born of that wonderful gathering in the streets of London last June, when the outposts of the British people came together to honor the aged and beloved Sovereign, has found, for our advancement, a practical rallying cry in "Canada and the Klondyke." Within the next few months Great Britain will pour into this, the first of her Colonies thousands of her sons, and a vast amount of capital The United States and other countries will contribute their quota in men and money, and Canada stands upon the threshold of a great national advance, that means not only an early increase in material wealth, but what is equally as important, that her natural resources shall at last be better understood and better valued, both at home and abroad. We who are directly interested in mining know that the "Klondyke" represents but a very small part of the great natural wealth this country contains, and we are therefore confident that properly directed, the workers and capitalists now coming to our shores, if by chance unsuccessful in their first adventures in the gold mines of Canada, can be absorbed to their own benefit and to that of the Dominion in the many other fields of lucrative labor and investment which this country affords. The wealth of our coal fields and iron mines is undoubted. We are rich in silver, copper, asbestos, mica, plumbago, phosphate, chromic iron, galena, corundum, talc, and almost every mineral known to science. Aside from mining, our rich agricultural lands, our forests and our fisheries, all afford ample scope for the profitable employment of capital and labor.

At such a time as this a distinct national duty rests upon all Canadians, and certainly upon the members of this Institute, to conserve, by every reasonable means, the interests of the workers and the capitalists that are now seeking our shores. They must be made to feel that Canada is a country where law and order will be guaranteed, and where the rights of individuals will be as safely guarded as in any part of the British Empire. Canadian citizenship should be made so attractive to the new-comers that when they come they shall elect to remain and assist in the general development of the country.

To better meet the requirements of the times so far as this Institute is concerned, it is felt by many of our members that the time has arrived when we must merge our Provincial Associations into one strong united Dominion organization, embodying the mining men of all the Provinces. Of this the members have already been duly notified, and during the course of the present meeting the scheme of consolidation will be fully discussed and probably carried into effect. In union there is strength. If a single powerful institute, carried along somewhat on the lines of the American Institute of Mining Engineers, can better protect the mining interests of this country than can separate Provincial organizations, then we should adopt that plan without delay, because unless all signs fail, we will shortly have excellent work cut out for us in preserving the good name of our common country, and especially of the interests with which we are so closely identified.

Speculators and boomers, common to every "civilized" country, are not unknown in Canada. It is feared that such men will carry more "steam," especially at the present time, than is safe either for their victims or for the good name of this Dominion. At such a moment, this Institute, whilst fully believing in the natural mineral wealth of Canada, can yet afford to act as a sort of "safety valve" to guard against the evil effects of "wildcat schemes" and the exaggerated reports that too often back them up.

Former experiences of mining ventures in Canada teach that there are other causes than these traceable to Canadian speculators and "boomers," against which the new-comers must be warned, (causes which they themselves can very largely control) and to which many of the failures in the past may well be attributed.

First. Undue haste in seeking to force Company shares to a premium before the properties which the shares represent have attained proper development.

Second. The expenditure of large sums of money in the erection of permanent buildings and plant before the "mines" at which they are located are properly proved.

Third. Lack of experienced management.

Without presuming to dictate to our English and European friends, the members of this Association may be permitted to express the opinion that the Canadian mining engineer, acquainted with his particular field of operation, experienced in the ores of this country, and fully understanding the climatic conditions under which the work has to be carried on, is better fitted to cope with and overcome natural difficulties, than, for instance, an engineer who may have gained his experience on the free milling reefs of South Africa. Climatic conditions must be taken into account and due allowance made therefor. Our Canadian climate in many sections of the Dominion precludes as rapid as opening of properties as do the climates of Australia, South Africa, or even Nova Scotia. For quite half the year the prospector is debarred from the mountain tops and those bare portions of the mountain side which are the first to be explored. Necessarily then the time occupied in prospecting such a country as British Columbia must be double that required in a country where there are no winter snows to cover up the formation.

That these natural disadvantages can be successfully met and overcome, has long ago been amply proven by actual and profitable work upon the part of mine operators now in the field.

During the present meeting papers and reports will be placed before you from eminent authorities in various branches of mining, that will convince the close observer (and a full discussion of these papers and reports is desired) that Nature has endowed this Dominion with enough good, honest mineral wealth to give ample scope, and at least reasonably remunerative returns to the energetic, intelligent, and persevering work of many thousands of men, and plenty of opportunity for solid, if intelligent, investment of capital.

Whilst desiring to avoid touching upon details that may, during the course of our meeting, be presented by the representatives of particular industries, it devolves upon me to review as briefly as possible, the general work of mining in Canada during 1897, and afterwards to place before you a synopsis of the work accomplished by this Association during the year.

The official returns of the Geological Survey of Canada, just published, calculates the total production of minerals in Canada during the year 1897, at $28,789,173, an increase of $6,179,348 over the production of 1896. In 1896 the total production of minerals in Canada only reached a value of $10,000,000. What can better attest the importance of developing the mining industries of the Dominion, than this advance of nearly 188 per cent. in the short space of eleven years? Few countries during the same period have shown such a percentage of increase in the production of natural mineral wealth.

The total values, as given in official returns, fail to convey an adequate idea of the real monetary value of the mining industry to this country, nor yet of the relative value of one mineral as against another. In the item of iron, for instance, it is taken (*vide* report of the Geological Survey of Canada for 1896) simply at the value of the ore mined, and not, as in the case of other minerals, at its value in a marketable state. The iron ores mined in Canada are almost wholly used in this country, smelted into iron and steel ready for the market, with fuel which by the way is credited in these Government statistics solely and alone to the coal miners, without giving one word of credit to the iron industry, which affords the market. The item of charcoal fuel, used in smelting Canadian iron ores, is altogether omitted. In dealing with the iron industry it would be well to give some more general information as to the value of all necessary raw material used. It is a debateable question whether in the table entitled "Proportionate value of different mineral products," page 8 of the report of the Geological Survey for 1896, iron should not be taken at its real value to the country, or at least some foot note of explanation afforded that will show to the uninitiated that this section of the mining industry approximates very closely in value and in national importance to the record credited in the report to the more "precious" metals.

In considering this question of comparative values it must be remembered also, that the Statistical Department of the Geological Survey have to depend upon the Customs Department for data as to the values of iron and steel imported into the country, and these appear in the reports at the actual invoice prices of the finished article, affording a very unfair comparison a

against the value of the Canadian industry, credited simply with the value of the iron ore consumed.

To review the different sections of mining separately, in so far as we have returns at hand for 1897 :—

Coal.

The coal areas of the Dominion are estimated at 97,200 square miles, not including areas known but as yet undeveloped in the far North. There are, first, the coal fields of Nova Scotia and New Brunswick; second, those of Manitoba and the North-West Territories; and, third, those of the Province of British Columbia. A very complete description of the Canadian coal areas can be had on reference to the *Canadian Mining, Iron and Steel Manual of 1897*. The operations for 1897, so far as reported by the Bureaus of Mines and the various Companies interested, show as follows :—

In Nova Scotia, coal raised.....	2,345,138 tons.
New Brunswick	6,090 "
Manitoba and North-West Territories.....	297,000 "
British Columbia, Vancouver Island Collieries.	798,458 "
	3,446,596 "

The production of coal for 1897 may thus be put down at a value of at least $7,000,000.

The output for 1898 will be increased by the coal raised by the Crows Nest Coal Co., whose colliery in the East Kootenay is now being opened and equipped with an entire electrical power plant, the first complete electric installation in Canada. The importance of the coal industry to inter-Provincial trade however is the paramount one.

Quoting from the figures given in the *Canadian Mining Manual* of 1897 : "In 1894, 49 steamers, 18 sailing vessels, and 2 barges were employed in the St. Lawrence-Maritime trade, when $369,688.00 were distributed for labor in transportation, trimming, cargo, handling, &c., and $55,556.00 for wharfage, and $55,333.00 for pilotage, in all a total for these three items of $480,577.00." This trade from the coal fields of the Maritime Provinces is one of very great and growing importance to the port of Montreal.

Comparative figures as to the tonnage of coal carried over the Intercolonial Railway from the Nova Scotian collieries to Chaudiere Junction and St. John for points West thereof, including tonnage to local station, in the year 1895-6, as against the tonnage at the commencement of the trade in 1876, afford the best evidence of the growth of the business and its importance to our Railway systems.

In 1876-77	103,420 tons.
1895-96	432,513 "

Coke.

Nova Scotia reports a production in 1897 of 58,000 tons of coke.

We are without actual figures of the production of coke in other sections, but it is gratifying to note that the coal companies of the Dominion are gradually extending their trade, export as well as native, through the medium of their coking plants.

Iron.

Blast Furnaces.

During the earlier months of the year the Nova Scotian furnaces, as well as the one situated at Hamilton, Ont., were practically closed down, awaiting the decision of the Government regarding tariff questions, affecting the industry. That happily settled, the furnaces went to work, (the Hamilton furnace as late as 29th June) with the result that at the close of the year, the returns show an output of coke iron pretty well up to that of 1896, and an increased output in charcoal iron. Advices received from New Glasgow, N.S., Londonderry, N.S., Radnor Forges, Que., and Hamilton, Ont., report a combined gross production of about 57,901 net tons of pig iron, 18,562 net tons of steel, 1,403 net tons of forgings, 4,646 net tons of bar iron, puddled bar and other finished products, the three last mentioned items reported by the Londonderry Iron Company.

The capital invested, the number of men employed, and the quantity of materials used, remain practically about the same as in 1896. The output of charcoal iron at the Radnor Forges furnace, included in the above returns, shows an increase of 50 per cent. over the operations of 1896. The whole outlook in the Canadian blast furnace business is promising. Tariff questions are at last upon a more settled basis, the wants of the country are increasing, and furnacemen and capitalists feel encouraged to go ahead and place the Canadian plants upon a thoroughly modern basis.

Our charcoal iron has taken front rank in point of quality, and so far as coke iron is concerned, Canadian founders now acknowledge the product of the home furnaces to be equal in every way to the imported American article.

Ferro-Manganese.

During the year the plant of the Pictou Charcoal Iron Co. at Bridgeville, N.S., has been leased to the Mineral Products Co., who are undertaking the manufacture of Ferro-Manganese. The Company has secured important concessions in manganese mines in Albert County, N.B. These operations will be watched with considerable interest by the members of this Institute, who wish the new venture every success.

Chomic Iron.

The returns for 1897 are not yet completed, but we are glad to be able to report shipments by the Quebec Central Railway to the extent of 2,593$\frac{1}{2}\frac{3}{8}\frac{3}{8}$ tons. The quantity shipped in 1896 from the mines of the Province of Quebec, with points of destination, was as follows :—

To Philadelphia.....	750	tons.
Pittsburgh	1,232	"
Other points	55½	"
	2,037½	"

Mr. J. Obalski, Inspector of Mines Quebec, estimated in his report for 1896 that during the preceding four years some 10,590 tons of Chromic iron had been raised, of which quantity 9,000 tons were shipped from the Province of Quebec. A concentrating plant plant is badly wanted to raise the values of a very large quantity of this mineral in the Eastern Townships, at present too low to market at a profit.

Mica.

Quebec Province reports a total production to the valuation of $125,000, and we are also glad to report English capital recently invested in Ottawa County mines. So far as trade is concerned, enquiries from abroad indicate a considerable increase in the consumption of this mineral for electrical purposes.

Phosphate.

Some phosphate has been taken out during the past year in workings for mica, and enquiries for this mineral are reported as more numerous, although the prices offered are yet too low to admit of actual business. The following valuable papers contributed to the transactions of the General Mining Association of Quebec in January, 1895, point the way to the possible deveopment of a Home market for this important mineral.

"Canada—A natural manufacturing centre for Fertilizers," by Mr. Henry Wigglesworth, of New York.

"Phosphoric Acid in Agriculture," by Frank T. Shutt, M.A., Chief Chemist, Dominion Experimental Farms.

"Canadian Phosphate and Fertilizers—Home Manufacture and Home Market," by Mr. J. Burley Smith, M.E.

"Phosphates Future," by Capt. R. C. Adams, Past President General Mining Association of Quebec.

Gold.

Of all our mineral wealth, gold has excited by far the greatest interest among investors during the past year. A large amount of foreign capital has been and is being introduced to develop new districts.

The total production in Canada in 1897 is reported by the Geological Survey of Canada as $6,190,000.

Yukon.

It will be indeed a fortunate thing for Canada if one-fourth of the rosy predications as to the wealth of the Klondyke placer mines are realized. For the moment that district is the Mecca of the gold seekers. Many of them may later on turn their attention and their labor to more profitable account in other better known and more habitable Canadian fields. Investigation and solid hard work will alone prove the richness or otherwise of the Yukon placers. Official returns submitted to Parliament estimate the total production of gold in the Yukon district in 1897, as not exceeding $2,500,000. What has been spent to secure that is not so easy to calculate.

British Columbia.

Mining in British Columbia during 1897 has been prosecuted on a more substantial basis than during the few preceding years. The "boom" element to a large extent disappeared from the country early in the year, and the work done last season was performed by those Companies or Corporations which were well financed at the start. There were very few new discoveries, that is to say, discoveries of new districts, and some of the older districts have not, upon development, shown the values that were expected of them, but almost all the sections which were producers in 1896 have increased their production in 1897, notably the Slocan, which has doubled its output, and the Trail Creek country, which has nearly, if not quite, doubled its production. It is only fair to say, however, that this is due almost solely to one mine, the Le Roi.

Dividends have been paid during the year by the Le Roi, Cariboo Mining, Milling and Smelting Company, the Fern, and other mines. The Cariboo Hydraulic, in which many Montreal people are interested, also showed a substantial profit on the year's operations. British Columbia contributes to the total production of gold in 1897, 130,009 ozs. valued at $2,080,600.

Nova Scotia.

The output of gold for the past year is given as 29,000 ounces, of a value of $565,500.00.

In this field the work is being carried on quietly, but yet upon a practical and profitable basis, that must sooner or later attract the favorable attention of outside investors.

During the past year marked improvements have been made in the methods of gold saving and methods of working. Future success will come from the development of low grade ores, and here it is worthy of remark that the Richardson Mine at Country Harbour has increased its milling capacity from 40 to 60 stamps. This is the largest gold stamp battery so far in Canada. The working costs are worthy of notice, the ore yielding something like $4.00 per ton, being won at the low cost of $1.60 to $1.65. Several of the Nova Scotian mines paid the owners good fair profits on the operations of the year.

It is gratifying to note that the recommendation of the Mining Society made last year to the Provincial Government, to appoint a metalliferous engineer to the Mines Department, has been favorable received, and it is hoped that a thoroughly capable and experienced metalliferous engineer may be appointed.

Quebec.

The operations in gold have been confined to one or two small companies doing work in Beauce County. The actual value of the output has not been reported. Some attention is being directed again to operations on the Chaudiere. One or two companies with small capital have been organized, and it is hoped that their efforts may be rewarded sufficiently to induce more attention on the part of capitalists to this unquestionably promising gold field. A vein of gold quartz is reported as having been located at Dudswell, on the line of the Quebec Central Railway. It is hoped that this will prove worthy of further investigation.

ONTARIO.

The Director of Mines reports the gold yield for the past year as follows :

Gold ores treated, 1897, 27,590 net tons, yielding goid, 11,412.17 ozs., of a total value of $190,244.00, being an increase of some $70,000 on 1896. This is largely from the Lake of the Woods and Rainy River districts. The 1897 output would have been greatly increased if the Sultana, the principal producer, had not been closed for the larger portion of the year, installing new mill and other machiuery.

No figures have been reported as yet regarding the work in Hastings County, where quite extensive operations have been conducted by English syndicates on the mispickel ores, which have demonstrated profitable extraction by the Sulman-Teed Bromo-Cyanide process. One of the most successful companies has undoubtedly been the Mickado, which yielded a fair profit to the English shareholders upon the first fourteen months operations, and it is said will pay a handsome dividend on its production in 1898. Other producers of bullion last year were the Foley, Olive, Sultana, Regina, and Crystal. A number of new mills have been put into operation, so that the output for Ontario will no doubt show a considerable advance in 1898. There seems to be no question but that Ontario is rich in gold, and only requires thorough investigation and development.

A matter of note is that important indications of gold bearing quartz are found in the Sudbury district at Lakes Wahnapitae and Tamagaming, This district, already famed for its deposits of nickel ore, is said to be very promising in gold.

Silver.— The total output for 1897 — 5,558,446 ounces, valued at $3,322,905.

These minerals continue to be the principal source of dividends in British Columbia, substantial profits having been realized by the Slocan Companies, among others by the Payne, Whitewater, Reco, Ruth, Slocan Star, and the Hall Mines, Limited.

In Ontario, it is worthy of remark, that a number of mines in the neighborhood of Port Arthur have been reopened.

In Quebec important operations were begun, and shipments made from Calumet Island, Ottawa County. A valuable deposit of argentiferous galena has also been discovered in Brome County, on the shores of Lake Memphremagog, which we learn is now being investigated.

Lead.— The total production in 1897 amounted to 39,018,219 lbs., of a value of $1,396,853.

Asbestos.— The Geological Survey Report gives the output of asbestos and asbestic as 25,262 tons net, valued at $324,700.

The shipments reported by the Quebec Central Railway for the year 1897 show :

Black Lake - -	1,020,425 lbs	
Thetford Mines -	16,110,135 "	
	17,130,560 lbs	8565-560 net tons.

The Asbestos and Asbestic Co. of Danville, Que., formed in 1896, largely of English capital, have established, and in 1897 largely extended their important works. Abont 300 men are employed, and while we cannot give the actual output of asbestos from these works, the tonnage has been very considerable during 1897, and will likely be an increasing one. The Ottawa County product was small.

It is pleasing to note the considerable trade that has sprung up for the refuse sand and short fibred asbestos for use as fire proof plaster, for which purpose it is admirably suited.

Copper and Pyrites.—Copper ore mined in the Province of Quebec during 1897 — 39,928 net tons. Of this quantity 31,080 tons went to the U.S., the remaining 8,848 tons being treated in Canada. These figures show an increase over those of 1896 of 7,448 tons exported to the U.S. and a decrease of ore treated at home of some 1,344 tons. The market in the U.S. has been in a healthy condition, with an active demand and well sustained prices throughout the year.

In Canada the reduction of the import duty on sulphuric acid has resulted, as feared, in opening our market to the American manufacturer, in consequence of which there is a decrease in the home production and also lower prices.

The Bureau of Mines of Ontario reports a production of metallic copper to the extent of 2,750 net tons, of a value at the works of $200,067.00.

Shipments of blister copper to Great Britain are reported by the Hall Mines Smelter at Nelson, B.C.

Nickel.—The Geological Survey report for 1897, just published, places the total production in Canada as 3,997,647, valued at $1,399,176.

Mr. Archibald Blue, Director of Mines of Ontario, reports :—

Nickel Ore smelted in 1897.....	96,094 tons.
Metallic nickel contents	1,999 net tons.

Value at the works, $359,651.00. In certain quarters efforts are being made to induce the Government to impose an export duty upon Canadian nickel.

Whilst it is of great importance to this country that her minerals should be brought to the highest possible point of manufacture before exportation, yet in simple justice to the capital already invested in nickel, under existing conditions, no radical change should be made without the most careful consideration. It is quite possible that the imposition of a duty might, for the time being, serve to displace Canadian nickel in the United States market in favor of New Caledonia.

Gypsum.—The output for Nova Scotia and New Brunswick combined, reached 150,000 tons.

Total productions for Canada in Gypsum reached 239,691 tons.

Other Industries.—The other industries, such as oil and natural gas, salt, graphite, and building materials, show no specially new features, and returns of same are not yet to hand.

On the whole the progress shown in the various mining industries of Canada during 1897, is more than encouraging. As a people, we are on the high road to a successful development of the natural mineral wealth of our country and to national prosperity.

In connection with the actual work of this Institute during the past year.

Publications of the Institute.—We may be permitted a certain amount of pardonable pride in the publications of our Institute, which we think compare favorably with those of any similar Mining Association of its age and and advantages. Our last volume contained some 29 papers, of service not only to active operators, but as a volume of reference to those interested in the mineral resources of the country. An important feature is the educational nature of these publications, which are now placed in the hands of the students of McGill University, and of the different mining schools, at a merely nominal charge, representing indeed an actual financial loss each year to the Institute, but which it is hoped will finally prove of permanent benefit to the whole country. Exchanges of publications are kept up regularly with Associations of a similar character throughout the world, and through this system a knowledge is spread regarding the rich mineral resources of Canada.

Grant to Publications.—It was very necessary, in view of the somewhat restricted financial condition of the Institute, to devise better ways and means for carrying on our work, and it was hoped at the commencement of the past year that some assistance towards the publications might be obtained from the Dominion Government. This has not yet been granted, but it will be brought again to the attention of the Government, and we have reason to believe that the outlook for obtaining State assistance is hopeful. This work is, to a large extent, a labor of love on the part of the members of this Institute, and whatever good is obtained thereby accrues to the country and the Dominion as a whole, and the expense should therefore we think, be borne, at least in part, by the Government of the country.

Legislative Work.—With regard to the action of the Institute in connection with the tariff as applied to mining machinery, the movement was made with a view to securing a more definite interpretation of the old law, in order to remove the friction consequent upon the somewhat ambiguous phraseology of the item, which provided for the free admission of "machinery of a class exclusively used and required for mining."

A misapprehension seems to have been created in the minds of mining engineers that this item implied absolutely free mining machinery. As a matter of fact this was not so, the item reading "Exclusively used and required in ". The Institute took particular pains to be informed as to what the exact interpretation of the Department would be, and were officially informed by the Controller and other Ministers that it was the intention to charge duty upon all machinery which could be used in other industries, such, for instance, as air compressors, rock drills, pumps, etc. The action of the Institute was therefore directed towards securing, if possible, free admission of all machinery other than that upon which the Government had decided to charge duty. In this way a distinct service was rendered by the Institute, for whilst the Government would not grant this in the exact form asked for, the Institute was requested to substitute a list of items which might be specified as a free list—a most difficult task, but one that has been accomplished with fair success. It is a matter of gratification to state that the Government have, to the knowledge of our officers, given a very liberal interpretation to the law throughout the past year, their endeavor evidently being to promote, by a liberal interpretation, as far as they legitimately could, the mining interests of the Dominion.

Civil Engineers' Bill.—The 1897 meetiugs of the Institute had hardly closed before we were informed of the endeavors of the Canadian Society of Civil Engineers to promote a Bill in the Nova Scotian House of Assembly for the protection of engineers. This, in the opinion of the officers and council of the Institute, was an excellent piece of legislation, in so far as it related to the profession of civil engineering. Unfortunately, however, the Bill contained certain clauses which, if carried into effect, would seriously interfere with the profession of mining engineering. While the Mining Institute heartily endorsed the principle involved in this legislation to protect legitimate engineers against the vagaries of the mining quack, yet they felt that it was the province of the mining men themselves to move in the matter at the proper time, and only after the fullest consideration. The Council therefore felt it expedient to interfere, and having secured the co-operation of the Nova Scotia Mining Society, on the representation of the Institute, the obnoxious clauses of the Bill were deleted.

A similar bill was also submitted to the Legislative Assembly at Quebec during the year, and successfully opposed. In this connection the thanks of the Institute are due to the energetic action of one of its most respected members, Mr. Geo. R. Smith, M.L.A.

British Columbia Mining Institute.—One of the most important and gratifying events of the year in connection with the Institutc, was the entrance of British Columbia into the Federation, enlarging our Institute by about 100 members, and making a practically unbroken union from the Atlantic to the Pacific, and one which may now very well merge into greater usefulness in a consolidated and powerful body, representing many working members and a vast amount of capital.

It is hoped that the members will give most earnest consideration to the details of the plan of consolidation which will come before them during the present meeting. The matter is of vital importance and deserves the fullest possible discussion in the most liberal spirit.

National Advertising.— Among other important questions that should be fully discussed is the advisability of impressing upon the Dominion Government the importance of establishing in the great centres of the world, such as London and Glasgow, Canadian Commercial agencies, where exhibits of our minerals and other products could be permanently established, and our resources thus brought prominently before investors.

Lacking, as we Canadians do, the advantages connected with direct Consulates, it is of almost vital importance that we should have fully qualified commercial men representing us in the great centres. In addition to this we should take advantage of such an opportunity of bringing our natural products to the notice of the world as will be afforded by the International Exposition which will take place in Paris in 1900. Canada's exhibit should take front rank on that occasion, and any money that our Goverument may expend to attain this end will be well invested.

Foreign Trade Arrangemrnts.— It is a matter of pleasure to note that the Federal Government has at present under consideration a project for the establishment of a line of steamers to ply direct between Canada and France.

The range of Canadian products for which a trade could be found in France, is to-day much greater than when the treaty now existing between the two countries was entered into. Many of our products are totally unprovided for in the present treaty, and where such is the case we are debarred from shipping to France in Canadian "bottoms," *i. e.* in stamers plying from Montreal, or other ports in Canada, to English ports. and there making trans-shipment to France. Upon such shipments France inflicts a maximum rate of duty, under clauses 54-59 of her customs law in regard to direct transshipment by water. To secure the privilege of having onr goods entered at the minimum rate of duty granted to our American and English competitors, enjoying the advantage of direct steamers, known as "French bottoms," we must either have a direct Franco-Canadian line, or arrange for an enlargement of our treaty rights that will permit of our saleable products being shipped by available Canadian vessels via British ports, and still be allowed entry into France at the minimum rates of duty, which are frequently 100 per cent. lower than the maximum rates now imposed, otherwise the Canadian producers must continue as at present to ship via American ports, thus being seriously handicapped by the addition of inland freight rates to New York and other ports of departure. This matter deserves the most earnest and immediate consideration on the part of our Federal Governmeut.

Thanks to Secretary-Treasurer.—I cannot close without bearing testimony to the invaluable service rendered to this Institute and to the enterprise of mining in Canada, by our esteemed Secretary, Mr. B. T. A. Bell. To his untiring energy is due in a very large measure any success that this Institute has been able to claim in the past. If we now merge into a larger field of usefulness as a consolidated association, as I trust we shall, it will be largely due to the earnest work of our Secretary, Mr. Bell, to whom the mining profession of Canada, if not the country itself, owe a debt of gratitude.

To the members of the Council I tender my best thanks for the loyal support they have accorded me during my term of office as President, and upon behalf of our Council, as well as for myself, I desire to acknowledge specially the valued counsel and assistance which the Treasurer of the General Mining Association of the Province of Quebec, Mr. A. W. Stevenson, has repeatedly rendered to the Institute during the past year. Upon every occasion that we have sought his matured advice upon matters of importance to the Institute, he has given us of his time and work more cheerfully, and I feel therefore that we cannot pass this over without public recognition.

Gentlemen, the important work of the meeting of 1898 now lies before you, and to it I know you will give freely of your best energies and abilities.

If I have taken much of your valuable time this afternoon, I plead an extenuation of my offence the vastness and richness of the subject, the mineral wealth of Canada.

MR. HAMILTON MERRITT: I wish to congratulate you, Sir, on the admirable address you have given us. With respect to my own Province, Ontario, I would only remark that the gold mining industry is rapidly taking a prominent place. The important additions to the milling capacity of the Province, warrants us in the belief that the increased production in 1897 will be continued during the coming season. I beg leave to move a vote of thanks to the President for his very excellent address.

ALDERMAN DAVIES (Toronto) seconded the motion which was carried unanimously.

MR. E. D. INGALL: With regard to gold mining in Ontario I would like to bear out all that Mr. Merritt has said. One point, however, that has not been emphasised enough is that throughout that Province there are areas of Huronian rocks, and among these, beyond any question, there will be found just the conditions which are shown to be be those of the Lake of the Woods and Rainy River districts. Another point to which I would like to draw your attention is that in the report by one of our staff on the Nova Scotia gold fields, there will be found very much that is applicable to the gold bearing region of Ontario. I think we may regard with considerable confidence the future of gold mining, not only in Nova Scotia and in British Columbia, but in the centre portion of our Province of Ontario as well.

MR. J. OBALSKI then read his paper describing the year's mining operations in the Province of Quebec. (This paper will be reproduced in our next number).

Mining Law and its Bearing on the Development of Mines and Mining Districts.

MR. FRANK C. LORING (Rossland) preseuted his paper on this subject (reproduced in a recent issue of the REVIEW).

MR. J. F. LATIMER (Toronto) referred to some of his experiences in British Columbia last season. He had known posts to serve in many cases for two locations. There were discovery posts sometimes where there was no mineral at all.

DR. GOODWIN (Kingston): I notice that many of the things which are advocated by Mr. Loring are at present embodied in the Ontario Mines Act.

MR. MERRITT: The Ontario Mining Law might be greatly improved by the acquisition of some features in the law of British Columbia.

MR. LORING: An important point is with regard to this indefiniteness of location. Many men make what they call blazing locations—the line is blazed so indefinitely that to-day a prospector may have a location here and to-morrow somewhere else. One man in Rossland made from 15 to 20 snow locations on which he realised a handsome profit and is now in Europe. There was no valid discovery. He blazed the ground and that was all there was to it. The mining inspector should have some facts with regard to where the location is made. Another important objection to the British Columbia law is the size of the claim. I do not think that any man can properly prospect 30 acres of land. The location should not be over 1,000 feet square. I would advocate less than that. In some parts of Colorado the claims are only 150 wide and 1,500 feet long. I do not believe that any one can properly prospect on these mountains.

THE CHAIRMAN: What is your opinion as to the size of the location?

MR. LORING: 1,000 feet square. At present it is 1,500 feet square or 50 acres. The theory to my mind is that mining property is different from other property. If you cannot work your claim you have no right to keep it. You are preventing an increase to the wealth of the country.

THE CHAIRMAN: What time limit would you give to the miner?

MR. LORING: I would say a twelve month's limit, and I do not believe that $100 worth of work within twelve month's is enough.

MR. INGALL: I understand that for some years the law of the apex was the lay of the location.

MR. LORING: Yes.

MR. LATIMER: I think there are cases in which the law should allow one to follow the vein and there are others where it should not.

MR. LORING: The apex law is the best. If I owned a vein I would prefer the old law.

THE CHAIRMAN: I think it would be well for us to put ourselves on record.

MR. LORING: Yes; now that legislation is contemplated in British Columbia.

DR. GOODWIN suggested the appointment of a committee to draw up a resolution.

THE CHAIRMAN appointed the following to report at a later session: Messrs. F. C. Loring, W. Blakemore, Dr. Goodwin, Hamilton Merritt.

The session then adjourned.

EVENING SESSION.

The evening session opened at eight o'clock; the President in the chair.

MR. JOHN E. PRESTON (McGill) read a capital paper on the "Ventilation of a Deep Metal Mine as Affected by Seasonal Changes of Temperature." (Reproduced elsewhere).

MESSRS. C. J. CHRISTIE and W. HYDE, both of whom had been in the Klondyke for many years, entertained the members with a graphic and vivid description of their experiences in the gold fields of the Yukon.

MR. SPENCER MILLAR, New York, terminated the session by presenting his paper on "Cable-ways as Applied to Open Pit Mining," illustrating his subject with a large number of stereoptican views of cable-way plants in Canada and the United States. We hope to reproduce this paper in a future issue.

Thursday—Morning Session.

THE PRESIDENT took the chair at eleven o'clock.

The following papers were presented:

"The Possibilities for Smelting in British Colnmbia," by R. A. Hedley, Nelson.

"The Mineralogy of the Carboniferous," by H. S. Poole, M.A.A.R.S.M., Stellarton, Nova Scotia.

"Concentrated Foods for Explorers and Prospectors," by J. T. Donald, M.A., Montreal.

"Mining on the Coast of the Mainland, B.C.," by G. F. Moncton, F.G.S., Vancouver.

"On the Strange Singularity of Colour in Some Forms of Asbestos," by R. H. Jones, F.S.A., London, Eng.

"Mining Machinery in the Slocan," by Howard West, A.R.S.M., New Denver, B.C.

"Notes on the Michipicotton Gold Field," by Prof. A. B. Wilmot, Toronto.

"Odd Notes on Mining and Smelting," by A. H. Holdich, Nelson.

THE SECRETARY reintroduced his resolution respecting the proposal to place an Export duty on ores and minerals, and as noted elsewhere, the motion on being put to a standing vote, was carried unanimously.

MR. W. HAMILTON MERRITT presented the Report of the Committee appointed to consider certain portions of Mr. Loring's paper on Mining Law.

Increased Duty on Lead.

MR. W. BRADEN, Pilot Bay, B.C., desired leave to snbmit a resolution recommending an increase in the present duty on lead and lead manufactures.

THE CHAIRMAN: Is this not going beyond the scope of our Institute into politics?

MR. BELL: There is a difference between matters of policy and politics. I take it it is quite within the sphere of a body of mine owners and mining engineers to discuss methods of legislation likely to affect the interests of the industry.

After some discussion Mr. Braden's resolution was held over until the Friday session.

MR. F. T. SNYDER submitted his paper (reproduced in our last number) on "Some Modern Forms of Milling Machinery." The paper was discussed by Messrs. Hardman, Miller and Snyder.

The session adjourned at one o'clock.

That Civil Engineer's Bill.

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

PROF. MACLEOD (Secretary of the Canadian Society of Civil Engineers) explained that immediately it was found that the clause respecting mining engineers contained in this Bill was objectionable to the Mining Institute it was withdrawn.

THE CHAIRMAN: So far as we are concerned we did feel that any legislation governing the profession of mining engineering, should emanate properly from an Institute representing mining engineers, and not from a body of civil engineers.

MR. P. W. ST. GEORGE, C.E.: We only hope that instead of, as we saw in the papers, your opposing the Bill going through any other House, you will do all in your power to help us.

THE CHAIRMAN: Certainly; as long as you leave the mining engineers alone. I hope we will all move for the good of the profession.

THE SECRETARY: It would have been better if the Canadian Society of Civil Engineers had sought our co-operation before.

MR. JOHN BIRKINBINE then delivered an address on "Commercial Progress as Influenced by the Development of the Iron Industry" (reproduced elsewhere in this number).

MR. BLAKEMORE moved a vote of thanks to Mr. Birkbinbine for his valuable contribution to their proceedings.

MR. MERITT seconded, and the motion was carried by acclamation.

The Progress of Mining in Ontario.

Mr A BLUE, Director of Mines, reviewed the progress of mining in Ontario, quoting the following summary of the mineral production of the Province:

Product.		Quantity.	Value.	Employes.	Wages.
Cement, natural rock	Bbls.	84,670	$ 76,123	70	21,500
Cement, Portland	"	96,825	170,302	101	67,560
Pressed brick, plain	No.	7,148,008	53,727		
Pressed brick, fancy	"	895,000	9,350	143	40,084
Roofing Tile		35,000	400		
Terra Cotta			35,8 0		
Paving Brick		4,567,880	45,070	66	23,226
Sewer Pipe			73,551	04	19,000
Petroleum	Imp. galls.	25,556,591			
Illuminating Oil	"	10,891,337	1,131,083		
Lubricating Oil	"	1,959,810	199,755		
Benzine and Naphtha	"	949,341	77,340	304	196,956
Gas and Fuel Oils and Tar		8,021,633	281,035		
Paraffin Wax and Candles	Lbs.	2,139,278	88,378		
Natural Gas			308,448	84	42,338
Salt	Tons*	54,686	249,880	210	58,530
Gypsum and products of	"	1,729	17,950		
Graphite and products of	"	400	8,500	15	5,000
Calcium carbide	"	574	34,440	30	12,544
Iron	"	24,011	288,127	130	40,000
Nickel	"	1,999	359,651	535	253,226
Copper	"	2,750	200,007		
Gold	Ozs.	11,412	190,244	430	212,966
Totals	1897		3,899,821	2,302	993,530
	1896		3,794,003	1,822	818,726

*Net tons of 2,000 lbs.

The following papers were then read:—

"Notes on Some West Kootenay Ore Bodies," by Mr. J. C. Gwillim, B.A.Sc., Slocan City, B.C.

"The Albertite Deposits of New Brunswick," by Mr. John Rutherford, M.E., Windsor, N.S.

"Notes on the Analyses of a Rare Mineral New to Canada," by Dr. W. L. Goodwin, Kingston, Ont.

The session adjourned at six o'clock until Friday morning.

The Gaspe Oil Fields.

The President took the chair at eleven o'clock on Friday:—

MR. B. T. A. BELL asked if the Bureau of Mines at Quebec, or the Division of Mines and Mineral Statistics at Ottawa, had received any statistics respecting the reported flow of oil in economic quantity at Gaspe, Que., quoting the following extract from the Prospectus of "The Irish Proprietary Oil Fields of Gaspe, Canada, Limited."

"The Directors have further to report that 21 drilling derricks have been erected in the neighbourhood of the prospecting wells; 14 wells are sunk to the petroleum deposits in the overlying porous sandstone. Eight are pumping wells, with a daily average output of about 8,000 gallons. Six others contain oil, which will flow without pumping when connected by short pipe lines to the main pipe line to receiving tanks. It is estimated that the daily output from these six wells will average 7,000 gallons. Seven other wells are in the course of being sunk, and are at the depths of from 900 to 3,090 feet. As these wells reach the oil deposits, the output will be largely increased. Three more new derricks recently erected in the amber oil districts are being fitted with the drilling plant necessary for reaching the oil.

"The Directors, in view of the increased output from additional wells, consider it most important, and in the interests of the Shareholders, to construct, at the Company's wharf property, a refinery capable of treating up to 40,000 gallons of crude oil daily; and this the Directors have now under consideration. The treatment of only *20,000 gallons daily* of the Company's crude oil would, apart from the by-products, for which there is a profitable market, give a daily production of about 12,000 gallons of refined oil or kerosene, or 3,600,000 gallons per annum, from which a profit of £72,000 per annum could be obtained, and double this sum would be realized if the refinery was worked to its full capacity. As the output of petroleum increases, other refineries may be erected with a like result."

MR. J. OBALSKI, Inspector of mines at Quebec, said he had received no information further than that published in his last report. The Petroleum Oil Trust, Limited, had spent very large sums of money in sinking wells at Gaspe, and he believed some oil had been obtained.

MR. E. D. INGALL, A.R.S.M., said the Geological Survey had no information of any such great yield as that reported.

MR. BELL: In this prospectus great prominence is given to the reports of the Survey, but the statements of Logan, Dr. Bell and others were made many years before the operations of the Petroleum Oil Trust were begun. In view of the importance of such an oil field to Eastern Canada, it would seem highly desirable that the Survey make a report upon the territory as early as possible.

MR. HAMILTON MERRITT was of the opinion that returns of mineral production should be compulsory.

MR. OBALSKI: The Mines Act in Quebec gives compulsory powers.

After further discussion Mr. Hamilton Merritt moved, seconded by Mr. Hardman, that:

"In view of the difficulty of obtaining official information regarding the production of petroleum in the Province of Quebec, this meeting is brought face to face with the question of compulsory statistics, it is therefore desirable that a committee to be nominated by the Chairman be appointed to take the matter into consideration and report at this afternoon's session."

The motion was carried unanimously.

The Chairman nominated the following committee: Messrs. Hardman, Obalski, Ingall, Hamilton Merritt and Secretary.

An Increased Duty on Lead and Lead Manufacturers.

MR. W. BRADEN, Pilot Bay, B.C.: I desire to submit the motion of which I gave notice yesterday, having reference to an increase in the present duty on lead and lead manufactures.

One of the greatest possibilities for industrial Canadian enterprise is the smelting and refining of the ores produced in British Columbia within the the limits of Canadian soil. Any means to accomplish this end, and not conflicting with any other interests, should obviously be supported.

Through the encouragement offered (though slight) by the Dominion Government, and the rapid growth of the mining industry in British Columbia, there are at present in operation two smelters, and one which is idle The two in operation are matting plants smelting with copper base; the one idle plant is essentially a lead smelter. Does this not seem a pregnant fact?

1st.—The United States smelters pay a premium—so to speak—for lead ore of the character produced in British Columbia.

2nd.—Up to recently there has been comparatively little "dry ore" produced, thus making the "Precipitation process" of smelting these ores unprofitable. During the past year this dry ore" production has exceeded 100,000 tons.

3rd.—The United States Government have so arranged the Customs Tariff on lead in ore and pig lead, that should lead ore be smelted in British Columbia, a higher duty would be levied on the resultant lead if shipped into the U. S. market.

A method to remedy this condition whereby such a compound tax on the lead ore miner of British Columbia, and indirectly on the people of Canada, is needed. It is an unsatisfactory state of affairs, when the mines of Canada produce more than sufficient lead within her own limits to supply her consumption, and import every pound used.

Therefore, it is indubitable that were a prohibitory import tariff placed on lead by the Dominion Government, Canada would be benefited in many ways, with no single interest to suffer.

1st.—The lead mining would receive an impetus by having a market for their ores close at hand.

2nd.—The Smelting and refining industry would be established on Canadian soil, thus benefiting railways, merchants and laboring classes.

3rd.—By establishing a large market for the Canadian coal and coke.

4th—Of the several thousand tons of lead (and zinc) manufactures now being imported, these industries would spring up and thrive in Canada.

5th.—The miner would still have the same market and keener competition for his ores, which conditions would not be true under the provision for an export duty on ores.

6th.—Consumers would have a home market for the supply, better assuring thereby more equitable prices than now.

Thus is shown the wide range of usefulness such a prohibitory tariff (similar to the one levied by the United States) would have, as being the means of marketing British Columbia lead in Canada, and thereby establishing a highly important smelting, refining and manufacturing industry in Canada.

He therefore moved:

Resolved,—That a committee be appointed to draft and present to the Dominion Parliament and other proper channels, a petition setting forth as it being the sense of this Institute (representing as it does, the mining and kindred interests of Canada) the desirability that an efficient import duty should be placed on lead and lead manufactures by the Canadian Government.

Mr. Bell seconded the resolution, which was carried unanimously.

The following committee was then appointed: Messrs. W. Braden, (Convenor), W. A. Carlyle, F. C. Loring, H. E. Croasdaile, J. E. Hardman, Dr. Goodwin and the Secretary.

The meeting then adjourned.

A Report on the Gaspe Oil Field Recommended.

The session re-opened at three o'clock, the President in the chair

Mr. Hamilton Merritt presented the following report of the committee appointed at the morning session:

"Your Committee begs to report that it views with satisfaction the fact that the various Provincial Mining Bureaus are armed with authority to collect mining statistics and to visit mines and mineral areas; and it considers that the strict enforcement of the law in this regard is of paramount importance.

"In view of further valuable discoveries of oil in the Gaspe Peninsula it is the opinion of your Committee that in the public interests it is most desirable that the Geological Survey af Canada should continue the investigations in that section of country at as early a date as possible, and more particularly with reference to the boring explorations which have already been made there.

"Further your Committee believe it to be in the public interest that the Inspector of Mines for Quebec be commissioned to report to his Government at the earliest practicable date, in the form of a monograph, the fullest possible information respecting past operations in, and future possibilities of that subject.

"It is also the opinion of your Committee that the policy of prompt examination of mineral fields being newly explored or developed, should be

adopted by the Provincial and Dominion Governments, so that special bulletins containing all the information available should be issued for the public benefit."

DR. GOODWIN: This report really means that it is the opinion of the Institute that a policy of prompt examination of fields that have been newly discovered or newly developed should be adopted by the Geological Survey and the Provincial Governments.

The report was adopted.

MR. BELL moved that the balance of the business stand adjourned until the evening; the meeting then took up the constitution of the Canadian Mining Institute.

EVENING SESSION.

At the evening session Mr. Percy Butler, (McGill), presented a carefully prepared paper "On the Moebius Processes for parting Gold and Silver as Carried on in the Guggenheim Smelting Works, Perth, Amboy, N.J." illustrating the subject with a number of excellent stereoptican views (the paper is produced in full elsewhere in this issue).

MR. JOHN BIRKINBINE: Mr. President, I think that any discussion on this paper would be practically a repetition of what has been said. I think that the scope for the young engineer to-day, or the field for the young engineer in electro-metallurgy and electro-chemistry is greater than ever before. We have in our colleges quite a number of young men who are graduating as electrical engineers, mechanical and sanitary engineers, graduating as chemists and metallurgists. Now what we want to do is to bring together the electrical engineer and the metallurgist. He is going to fit himself for important positions in the future. It seems to me that there is a large field for those who take up electricity; not as you and I learned it, because when I studied about electricity it was a practically unknown quantity compared to what it is to-day. You must remember in 1876, at the Centennial Exhibition, over 20 years ago, there was an electric light shown which illuminated a portion of the building and sometimes it did not. Seventeen years after that Chicago was a blaze of glory. That is merely an indication of the progress made. I want to congratulate the young man on his paper. I think the idea of introducing student papers at a meeting of this kind an admirable one.

DR. GOODWIN also congratualated Mr. Butler upon the excellence of his contribution.

Votes of Thanks.

MR. BELL moved a vote of thanks to the management of the Windsor Hotel for the excellent accommodation provided and the uniform attention of its employees during the meeting; to the Montreal Street Railway Co. for its kind invitation to the members for a drive through the city; to the Faculty of Mining at McGill for its invitation to the new mining laboratories; to the students who had contributed papers; to the press for their excellent reports of the proceedings; and to Mr. George Macdougall for his assistance and the use of the lantern.

The motion was carried. The proceedings terminated with a hearty vote of thanks to the Chairman.

The Canadian Mining Institute.

REORGANISATION COMPLETED—OFFICERS ELECTED FOR 1898-9.

As a representative meeting of mining engineers, mine managers, and mine owners, held in the Windsor Hotel, on Friday evening, 4th March, the reorganisation of the Federated Canadian Mining Institute was completed. The session was largely taken up in considering and amending a draft Constitution and By-Laws. It was unanimously decided to have the new body Incorporated, and a Bill for this purpose has been prepared and is now before Parliament. The following Officers and Council were elected :—

Patron: His Excellency the Right Hon. the Earl of Aberdeen, Governor-General.

President: Mr. John Hardman, S.B.M.E., Montreal.

Vice-Presidents:

Mr. W. A. Carlyle, M.E., (British America Corporation) Rossland, B.C.
Mr. George M. Dawson, C.M.G., (Director Geol. Sur. of Can.) Ottawa, Ont.
Mr. John Blue, C. & M.E., (Eustis Mining Co.) Eustis, Que.
Mr. Charles Fergie, M.E., (Intercolonial Coal Co.) Westville, N.S.

Secretary: Mr. B. T. A. Bell (Editor CANADIAN MINING REVIEW) Ottawa.

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

Council :—

Mr. John B. Hobson, M.E., (Consolidated Cariboo Hydraulic Mining Co.) Quesnelle Forks, B.C.
Mr. Wm. Blakemore, M.E, (Crow's Nest Coal Co.) Coal Creek, B.C.
Mr. R. G. McConnell, B.A., (Provincial Mineralogist) Victoria, B.C.
Mr. Frank C. Loring, M.E., (Josie Gold Mining Co.) Rossland, B.C.
Mr. Henry S. Poole, M.A., A.R.S.M., (Acadia Coal Co.) Stellarton, N.S.
Mr. Wilbur L. Libbey, (Brookfield Mining Co.) N. Brookfield, N.S.
Major R. G. Leckie, Truro, N.S.
Mr. Clarence H. Dimock, (Wentworth Gypsum Co.) Windsor, N.S.
Mr. George R. Smith, M.L.A., (Bell's Asbestos Co.) Thetford Mines, Que.
Mr. George E. Drummond. (Canada Iron Furnace Co.) Montreal.
Mr. John J. Penhale, United Asbestos Co.) Black Lake, Que.
Mr. J. Obalski, M.E., Inspector of Mines, Quebec.
Mr. A Blue, Director of Mines, Toronto.
Mr. James McArthur, (Canadian Copper Co.) Sudbury, Ont.
Mr. W. Hamilton Merritt, A.R.S.M., Toronto.
Mr. F. T. Snyder, (Ottawa Gold M. and M. Co.) Keewatin, Ont.

After electing one hundred and twenty-five members, the meeting adjourned at eleven o'clock.

Sinking.

By Mr. G. E, J. MCMURTRIE.*

Although there are comparatively few systems of sinking, yet the great variation in the hardness of strata and the quantity of water yielded make this subject both an exceedingly attractive one and frequently a matter of the greatest difficulty.

Sinking may be grouped under four heads :—

1.—In firm or strong ground requiring little or no temporary support, either (*a*) free from water, or (*b*) producing so little that it can either be filled up in the debris, or that the winding of a few barrels per hour will keep the bottom dry; or (*c*) if sufficient to cause inconvenience, can be forced to land by a small hanging pump.

2.—In sandy or running strata, with water which can be passed through by (*a*) piling, (*b*) wooden drums, (*c*) cast-iron drums; and winding the water and sand in each case, or pumping the former and winding the latter.

3.—In strong, heavily-watered strata requiring a very heavy expenditure on pumps, and which from a knowledge of other sinkings in the immediate neighbourhood, it is known can be penetrated economically by the Kind Chaudron process, or in which this process is adopted after the failure of other systems.

4.—In quicksands and heavily-watered shifting strata, when possibly after attempting to pierce it by one of the above methods, Poetsch, or Gobert's system of freezing has to be adopted as a last resource.

It is seldom that Nos. 3 and 4 are adopted in England, but on the Continent a large number of most difficult sinkings have been successfully completed by both these systems, and in several cases after the failure of other methods.

Form of Shafts.

Shafts are either circular, elliptical, polygonal, rectangular, or square. In England circular shafts are general. In Scotland, on the other hand, rectangular shafts have been the rule.

The circular is the strongest form of shaft, the cheapest to sink, and the easiest to secure by tubbing.

The elliptical shaft is sometimes adopted in order to provide the additional room required for Cornish pumps.

Rectangular shafts utilise all the area excavated; but this has serious disadvantages, as the spare room of circular shafts principally provides the area required for ventilation. Rectangular shafts are generally secured by side and end timbers, supported and divided by cross-stays, or buntons, into separate divisions for pumping, winding, and the haulage ropes.

The first cost of this is greater than that of brickwork, while it has a shorter life and a great risk of being fired. In case of a fault passing through the shaft, the danger to the men and the cost of securing the sides is also greatly increased.

The size of the shaft must primarily depend on the tonnage to be wound in a shaft. Knowing this, the speed of winding, the size of the trams, and the number of trams on a deck, the number of decks, and the size of cage used, are the principal factors. Room must also be allowed, where necessary, for pumps and for a generous ventilation, as usually both shafts, sooner or later, are utilised for coal winding.

The shafts should, in order to concentrate the plant and save labour, be only a short distance apart.

The surface and pit-bottom levels of the two shafts should in each case be the same, in order to divert the output to either shaft in case of falls or accidents to the haulage ropes.

Explosives.

The explosives hitherto generally used are gunpowder and dynamite, or gelygnite, the former in dry ground and weak strata, the latter in wet or heavily watered ground and strong strata.

Many advocate the excessive use of the explosive, in order not only to lift the ground, but also to break up the stones ready for loading into the kibble or bowk, and so increase the speed of sinking at an increased cost of explosives.

In ground that is wet, but not heavily watered, gunpowder can be used by lining the hole with clay by means of a bull.

At Harris's Navigation, in hard and wet rocks, dynamite saved tamping, and required half the number of holes that powder did; in shale and soft strata free from water, powder was more effective. On the other hand, Mr. Coulson advocates the use of a high explosive in both hard and soft strata, to economise labour in drilling the holes.

The introduction of firing by electricity, by means of magneto exploders, has proved both a great safeguard and economy. Of the two systems, high and low tension, the latter is to be preferred, on the ground that all detonators can be tested by a galvanometer before being taken down the pit, and that the whole blast can be retested after being coupled up, thus ensuring the firing of the shots. On the other hand, high-tension exploders will fire more shots at once.

Separate cables should be used, and placed two or three feet apart in the pit.

As compared with the so-called safety fuses, electric firing has the following advantages:

A certainty of firing all the shots after proper testing, whereas instances are on record of fuses having hung fire for twenty-four hours, and then the shot having exploded and caused loss of life. No shot can be fired till the battery is coupled up, and this the chargeman has to do after leaving the bottom; there can thus be no risk of premature shots.

Fewer precautions need be taken against water than with fuse, and shots can be fired under water.

Little or no smoke is given off by the detonators, and the men are able to return earlier to their work, thus ensuring greater dispatch and economy.

The firing of all the shots is absolutely simultaneous; thus the smoke made by the shots clears away quicker, while the shots assist one another, and thus require less explosive.

*Paper awarded a prize, in competition for the Lewis Prizes, South Wales Institute of Engineers.

Drills.

Holes may either be bored by hand, or by machine drills. The introduction of patent hand-boring machines has largely replaced the ordinary chisel, except in very hard strata. These machines are readily fixed and yield an increased speed, but will not face really hard strata. The writer has found the ratchet machine to be the best for this purpose.

The larger areas taken, the deeper shafts now sunk, and the necessity of greater speed in sinking, has brought about the introduction of machine drills, driven generally by compressed air.

Great difficulty was experienced in fixing them. An arrangement of a central upright with three or four radial wooden arms hinged to it, and tightened against the side with screws, by which means the central upright is also tightened, was generally used. Upon the top of the central upright a plate is placed, to which stretcher-bars can be attached in the angles, and also tightened by screws to the sides.

The drilling machines are attached to these bars by clamps, which slide along them. On the completion of the holes the whole is drawn up the shaft by a crab, the stretcher-bars first having been removed and all screws slackened.

The Galloway walling stage is now sometimes used for propping against, and a very similar arrangement — namely, a heavy circular iron frame with screws to set against the sides, and hanging on two ropes off two drums worked by a crab engine, is said by Mr. F. Coulson to be the best arrangement of this kind, but is difficult to keep steady when the drills are running. He states that there is no difficulty in working machine drills on ordinary tripod stands with adjustable legs, which are light, portable, and readily fixed. They are steady in work, and holes can be put in with them against the shaft side, while they can be fixed on rough ground.

The actual time taken up by machine drilling is not great, but the placing, fixing, removal and repairs to the machine take up much time.

At Harris's Navigation, the diamond drill was tried in various ways, and also the Beaumont and Ingersoll drills. These last gave excellent results and consumed less air. Three drills were used at any one time, and ten holes blasted twice in every shift of eight hours; the sumping holes being put in at an angle of 35°, and the next set of holes at a less angle.

With the percussive drills, the 1¼ in. holes were bored 3 ft. to 3 ft. 6 in. with two changes of drills, in hard rock. Four men with two drills bored ten holes in 2½ hours, while three men took 2½ hours to put in one hole by hand. It took five minutes to fix and start a drill, and fifteen to twenty minutes to bore a 3 ft. hole in hard Pennant rock. Ten men were in the pit-bottom each shift, the central rubbish first being removed. Each shift had to put in the sumpers, and the rest of the pit-bottom was cleared whilst this was being done, and the benchers and cropping holes were then drilled.

In hard wet Pennant rock, 2½ yds. per week were an average, and 3 yds. good work with hand drills; and 3½ yds. an average, and 4½ yds. were frequently got with machine drills. Messrs. Brown and Adams concluded that the cost of machine drilling was less, and the speed considerably greater. The machinery used could afterwards be utilized for haulage purposes, and interest and depreciation of the machinery alone was charged against the cost of machine drilling. The cost of sinking one yard in Pennant rock, with three percussive drills, and with pumps, cost £10 10s less than that of sinking through the same strata by hand; while without pumps, and under similar conditions, the reduction in cost was £9 16s. per yard. Mr. F. Coulson has recorded more recent practice, and has recommended in Pennant rock nine sumping holes 4½ feet deep, and twenty to twenty-two canch holes around the side about 4 ft. deep. In ordinary sandstone nine sumping holes 6 ft. deep, and eleven to thirteen canch holes 5 ft. deep In shale or mild sandstone, nine sumping holes 6½ ft. deep will clear 6 ft., and at most require but two or three additional short canch holes.

The depth sunk in each round of holes is:

Hard Limestone - -	4½ ft. in	18 hours.
Hard Sandstone - -	5½ "	18 "
Shale and Sandstone -	6½ "	16 "

The quantity of explosive (Gelygnite) used was: In hard stone for a length of 4½ ft. to 5 ft.—

Nine sumping holes, 3 lb. each - -	27 lb.
Twenty-four canch holes, ¼ lb. each -	15 "
	42 lb.
In mild stone for a length of 6 ft—	
Nine sumping holes, 3½ lb. each -	31½ lb.
Eight canch " ¼ " " -	6 "
	37½ lb.

The excessive amount of explosive used is to break up the stone ready for removal, 130 tons in hard stone and 155 in mild stone were the averages lifted by each round of shots. Three men will drill six holes with the two machine drills, while twelve men drill four holes by hand. In hard stone, rock drills do the same work as men with hand drills in half the time.

The cost in very hard limestone without partings, for a week (May 1894), and for a depth of 30 ft., was £12 2s. 9d. per yard, and the cost in coal measure, in shale, and sandstone, for a depth of 30 ft., was £8 11s. 6d. per yard.

Four rock drills were required to do this; two capable of drilling holes 7 ft. to 8 ft. deep, and two of 6 ft. deep.

Diamond drills have been found too slow; rotary drilling engines, both with twist drills and diamond drills, have only been moderately successful.

Percussive rock drills, with long stroke and an automatic rotating arrangement and a screw worked by hand, are most suitable for this work.

A given length should be driven by each series of holes, and all the holes fired simultaneously, either by electricity, or quick-running fuse. The drills also should be got into the shaft bottom as soon as a place can be cleared.

[TO BE CONTINUED]

British Columbia Miners' Association.—At the regular monthly meeting at Golden on March 4th Mr. Drinard presided, in the absence of the President. A motion was passed requesting the Minister of Mines to abolish that section of the Mineral Act which permits assessment work to be avoided by the payment of $100 in the treasury. The resolutions passed at Rossland recently regarding the employment of Chinese labor in the mines of the colony were discussed and indorsed. A motion made by Mr. McNeish favoring an amendment of the Mineral Act, providing that a permit should be obtained from the Gold Dommissioners before a claim could be re-located and that a claim should be held 12 months prior to re-location, was also passed.

With a view of acquiring mining claims in Pyramid Camp, East Kootenay, British Columbia, the Pyramid Copper Syndicate, was registered on the 4th inst., with a capital of £20,000 in £1 shares.

British Columbia Bullion Extracting Company.—Work on the reduction works of this company, located about 2½ miles from Rossland, will be resumed soon under the direction of Mr. Lionel H. Webber.

With a capital of £11,000 in £1 shares the Klondike Mining and Promotion Company, Limited, was registered on the 3rd inst.

Ontario Prospecting Company.—The Stella, owned by this company, has had about 100 ft. of drifting and the same amount of sinking done since last spring. A shipment of 20 tons of ore to the Keewatin Reduction Works recently gave about $27 gold per ton.

The registration was effected on the 8th inst. of the Newfoundland Copper Company, Limited, which has been formed with a capital of £250,000 in £1 shares, ro adopt an agreement with the Terra Nova Mineral Syndicate, Limited, and to acquire mining rights, etc., in Newioundland or elsewhere.

Hall Mines Contract for Wire Rope.— The Hall Mines Company at Nelson, B.C., is reported to have contracted with the Dominion Wire Rope Company of Montreal, for ten miles of "Lang Lay" wire rope for its cable-way. The weight of this rope is said to be 40 tons.

Gold Mining at Lake Wahnapitae, Ont.— At the northeast end of the nickel range, on Lake Wahnapitae, there is a somewhat peculiar gold-bearing belt of massive argellites, conglomerates and slates. The veins are mostly small, but many show free gold on the surface. A large number of claims have been taken up within the past two years, but very little development work has been done, as the land is withdrawn from sale until the pine is taken off. At the Crystal mine a good deal of ground has been opened in shafts, drifts and slopes, and a 5-stamp mill was erected last spring, and kept running some months. The company is a close corporation, and will say nothing about the output of the mine or mill. On the adjoining location a test shaft has been sunk 100 ft. and a drift run, but work was suspended last fall. At the lower end of Kookagaming Lake, where the leads are more in place, several claimes are being opened up with the most promising results.

The Canadian United Gold Fields, Limited, was registered on the 2nd inst., with a capital of £250,000 in shares of £1, to adopt an agreement with the London and British Columbia Alliance Syndicate, Limited, and an agreement with Mr. W. J. R. Cowell, on his own behalf and on behalf of the Victoria Metallurgical Works Company, Limited, and to carry on in British Columbia or elsewhere the business of miners, explorers, traders, etc.

Preston Gold Mining Company of Ontario.— This Company, the owner, has formed the Olive mine into a subsidiary company with a capitalization of $1,000,000, of which the present company takes $500,000 ; $100,000 of the treasury stock is to be placed on the market at par, for the purpose of providing additional plant to work the property on a larger scale. Shaft A is down 125 feet and has about 130 feet of drifting east and west. The vein is about 3 feet wide and mills at present about $40 to the ton in gold

Foley Mines of Ontario, Limited.— The north shaft is now down 320 ft. Considerable drifting has been done at the 300-ft. level, where the vein varies from 3 to 6 ft. wide. The new air compressor runs well, and the mill is working steadily.

Ontario Limited.— Work is being pushed on this property with about 15 men. No. 1 shaft is now down about 60 ft. and No. 4 about 35 ft.

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For further information see the calendar of Queen's University.

4—Prospectors' Course.

The School offers to Mine Foremen, Assayers, Prospectors and Mining Men generally, Special Courses of Instruction beginning January 4th, 1898, and continuing eight weeks.

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FOR CALENDAR OF THE SCHOOL AND FURTHER INFORMATION APPLY TO

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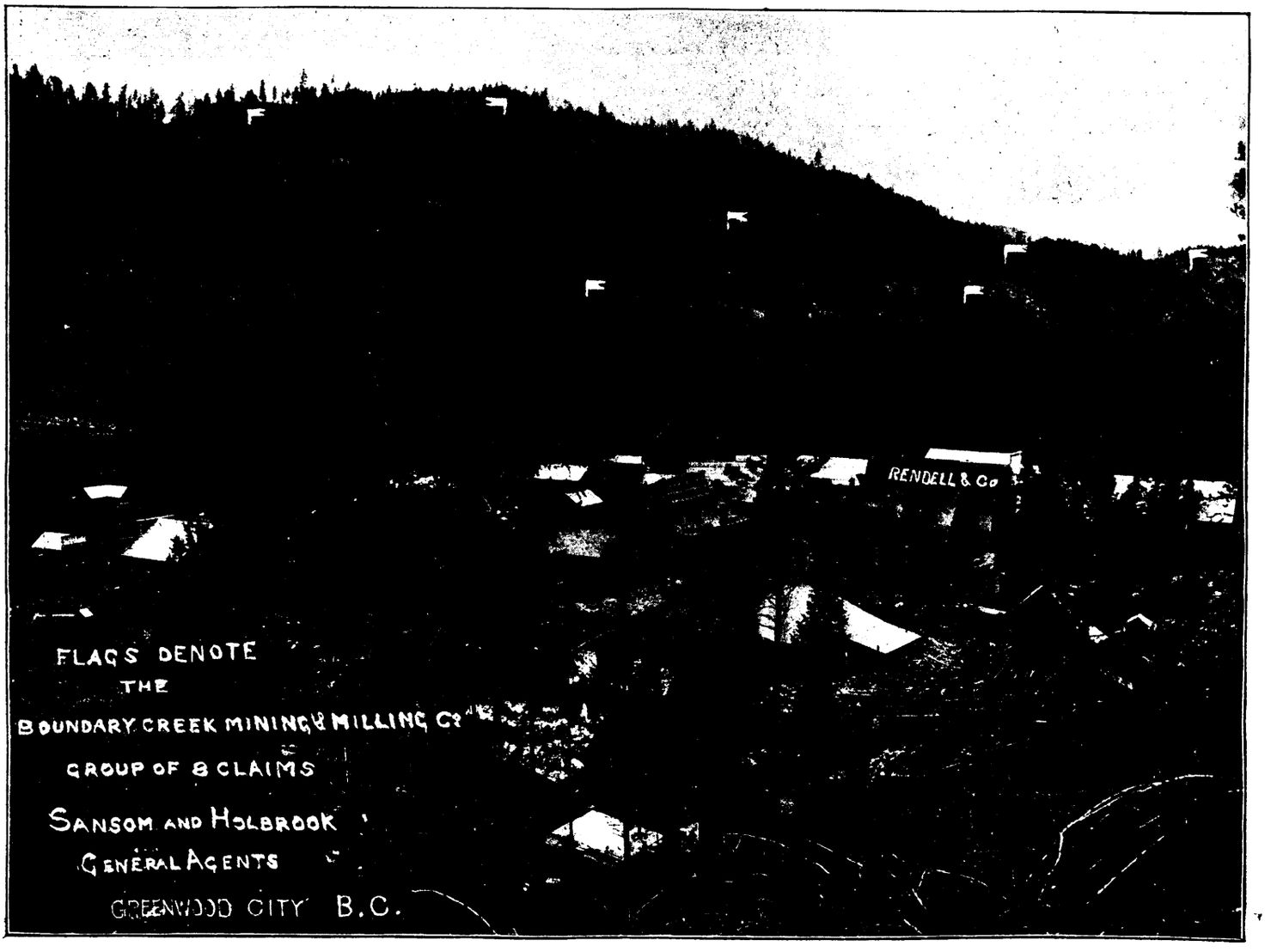
This Company owns and operates a group of the highest grade in Gold, Silver and Copper properties in Boundry Creek.

CLAIMS—The G. A. R., D.A., O. B., S. H. B., J. A. C., FRED D., S. F., C.S. & H., D.H. and BIG LEDGE, constitute the group, which is the most compact and advantageously situated of any under one ownership in Boundary Creek. The proposed Columbia and Western R.R. being surveyed to pass right through Greenwood City and along the base of the hill.



From the above photograph it will be readily seen that, lying as they do on a steep sloping hill, the properties offer unusually good facilities for drainage and rapid and economical development, by main working tunnels driven in from the base of the hill.

The veins lie in the Granite Area—which occupies the upper part of Boundary Creek basin—along the line of contact with the more basic eruptures, and are among the oldest locations in the camp.

A small shipment of 8,653 lbs. was made to the Everett smelter in 1894, yielding per ton, Gold, $103.15; Silver, 74-7-10 ozs.; Lead, two per cent., and a considerable amount of shipping ore is at present on the dumps of the different claims.

Careful investigation is earnestly invited by the Company, as their properties are being developed with a view to making mines and not to booming stock.

Attention is drawn to the large amount of stock (700,000 shares) put into the Treasury, and to the fact that the properties are all fully paid for.

150,000 Treasury shares fully paid up and non-assessable, have been put on the market at 10 cents, and most of the stock so far sold has been taken up locally. A large proportion of the miners now working are also taking stock in payment. For further particulars address

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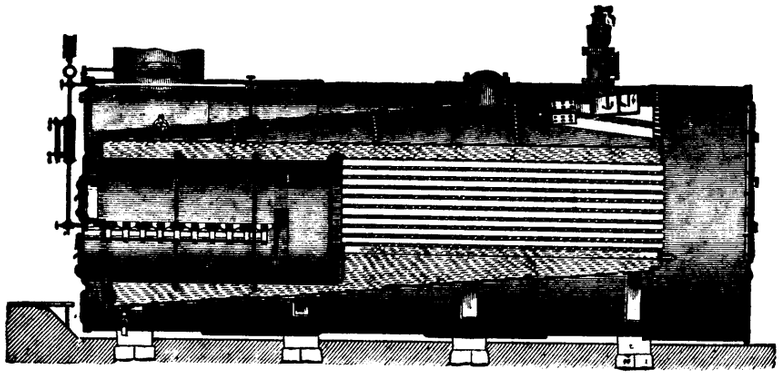

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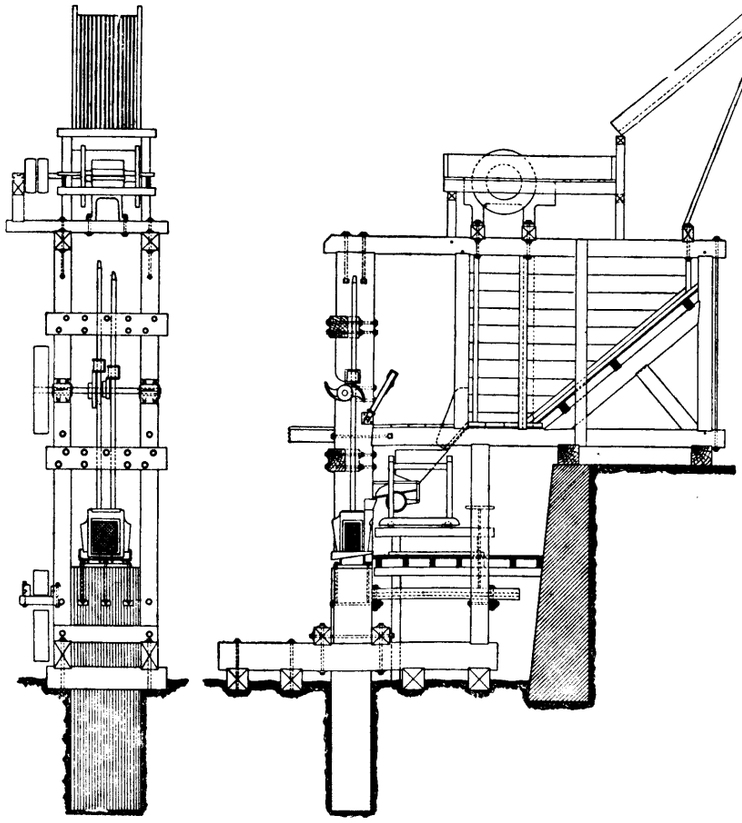

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